THE INFLUENCE OF MATERNAL FATNESS, KNOWLEDGE, AND DIET ON INFANT AND YOUNG CHILD FEEDING IN MEXICO

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THE INFLUENCE OF MATERNAL FATNESS, KNOWLEDGE, AND DIET ON INFANT AND YOUNG CHILD FEEDING IN MEXICO

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

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August 2010

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Cornell University 2010

Maternal decisions about breastfeeding (BF), formula feeding, and complementary feeding are guided by biological and socio-cultural factors. Obese women often experience poor BF outcomes. Maternal weight is also a proxy for the food environment because diet is a determinant of weight. Our understanding of cultural knowledge and the mother-child food relationship in complementary feeding remain fragmentary. The aims of this dissertation were to examine the association between maternal fatness and child feeding practices from 0-24 mo and understand conceptualizations and practices of child feeding, particularly the mother-child food relationship within the household food environment. First we examined if maternal fatness was associated with BF duration, dietary diversity (DD), and child feeding index (CFI), using data from Mexican mother-child pairs. Maternal fatness was not associated with BF duration or DD. Maternal fatness was not a significant factor in CFI as measured by the index.

Second, ethnography was used to examine how 31 mothers in Xoxocotla, Morelos, Mexico conceptualized complementary feeding practices. The eight concepts identified were: *probaditas,* preparing separate foods, readiness to eat solid foods, consistency, variety, child likes and dislikes, money and food costs, and healthiness of foods. There was strong evidence of cultural consensus. Household factors influenced feeding practices.

Last, data from 24-h recalls of 25 mother-child pairs (9-18 mo-old) from the

ethnographic study were used to examine the maternal-child food relationship and the household food environment. The frequency of shared meals and foods between mother and child was attributable to maternal concepts of child foods, time of day, the child's age and sleep patterns, family and maternal food preferences, maternal social roles, and presence of family members at meals. This complexity was captured by the maternal and child food space concept. This dissertation showed that maternal fatness was not of public health significance in child feeding, whereas maternal knowledge and household food environment were important. The ethnographic findings have implications for how we approach child feeding, such that to improve practices we must use the maternal system of knowledge and consider the social processes that construct the complementary diet beyond educating mothers on food quality and consistency.

BIOGRAPHICAL SKETCH

Eva Monterrosa was born in El Salvador. At the age of 5 y her parents immigrated to Canada where she was raised. Her family moved to Chile when she was 17 y old and it was there where she began her nutrition training. Shortly after, her parents relocated the family to the United States but she decided to complete her nutrition studies at the University of Alberta, Canada. While completing a Bachelor's in Nutrition and Food Science, Eva also undertook her dietetic training, obtaining her Registered Dietitian credentials in 2003. That same year, Eva began her Master's program at the University of Alberta with a focus on international nutrition. The field work, which was completed in Guadalajara, Mexico, gave Eva the opportunity to design and manage a longitudinal clinical study to ascertain how child feeding from 0-6 mo affected the health and growth of infants. This work led Eva to the Program in International Nutrition at Cornell University to pursue her interests in infant and young child feeding and to receive training in epidemiology, anthropology, and development sociology. For her post-doctoral training, Eva received funds from the Alive and Thrive Small Grants program (funded through the Gates Foundation) to pilot an intervention to improve complementary feeding practices in Morelos, Mexico. The intervention is a direct result of the dissertation work presented here.

To my mother for her unwavering and unconditional support

ACKNOWLEDGMENTS

This dissertation is the culmination of a long journey. I would like to acknowledge all those who have had a hand in seeing me through this process. I am grateful to Lynnette Neufeld for providing access to the secondary data and for supporting my work in Xoxocotla. Her knowledge of the community was invaluable. I am especially grateful to Ed Frongillo for recruiting me to Cornell. As a staunch supporter of my work, Ed has been unselfish with his expertise and time. I am blessed to have crossed paths with him early in my career.

I came to Cornell in search of knowledge and mentorship and I found it in three great faculty, Phil McMichael, Gretel Pelto, and Kathy Rasmussen. Phil was the professor who "blew my mind"—literally. His classes were an intellectual challenge, a Rubik's cube that I slowly learned to solve, but when I did, food and nutrition were never the same for me again. He sowed seeds of knowledge on fertile soil, and I am very grateful for his mentorship. Gretel, the intellectual architect of the ethnographic portion of this dissertation, selflessly gave her time and ideas, helping me make sense of what I wanted to ask and what I had uncovered. It was an honor to have learned from the scholar who pioneered the field of nutritional anthropology. Kathy, my committee chair, was the winning ticket. Kathy provided the intellectual environment that I needed to flourish as a scholar. She pushed for clarity of thought, methodological rigor, preparedness, discernment, and insightfulness. Most importantly, she saw my potential and believed in what I had to offer even when I did not. I am indebted to her.

To my family, Dad, Nati, Vini, Marc, our conversations and laughter were invaluable sources of support. To my friends, Michael and Christine, who challenged me to see nutrition differently. To my girlfriends, Sunny, Rebecca, and Anne, who listened, laughed, and shared the ups and downs of this incredible journey. To the

mothers in Xoxocotla who graciously shared their cultural norms about child feeding. Finally, and perhaps most importantly, to my mother, who envisioned that all this was possible and who made sure, at all costs, that I achieved this dream. I love you dearly.

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Introduction

1.1 Background

1.1.1 Over-nutrition and undernutrition are public health problems in the Americas.

In the last 30 y, the prevalence of overweight and obesity in women has increased dramatically. In Mexico, 71% of the women of childbearing age (12-50 y) are overweight or obese[1] (1). In Colombia, Nicaragua, Chile, and Panama more than 50% of women are either overweight or obese (2). Of even greater concern is that an estimated 2.4 million (4.3%) preschool children in Latin America are overweight (3). Once thought to be a disease of the affluent, obesity now affects the more disadvantaged sectors of society—women (4), the poor (5), indigenous populations (6), and rural dwellers (7)—while childhood stunting (7, 8) and anemia remain a problem in these populations (1). Middle- and low-income countries must now deal with obesity and undernutrition in what is called the double burden of malnutrition: the coexistence of maternal overweight with child stunting in the same household (7).

Not only is the prevalence of overweight and obesity exceedingly high in Latin America, but these changes have also occurred in a relatively short period and much faster than in industrialized countries (5). Urbanization, technology, decreased physical activity, and a shift from a plant-based diet to the consumption of processed foods high in refined sugars and fat (5) are implicated in the development of obesity in the region. Obesity and its sequela (i.e., cardiovascular disease, diabetes, and certain

[1] The World Health Organization (WHO) defines overweight as a body mass index (BMI) 25-29.99 kg/m^2 and obesity as BMI $\geq$ 30. The BMI is a measure of adiposity.

types of cancers) demand large health expenditures from government and represent a loss in quality of life for sick individuals and society in general (5). For this reason, obesity is best managed using integrative and preventative approaches (5).

The high rates of obesity among women of childbearing age are detrimental for child growth because maternal obesity is a risk factor for childhood overweight (9), and the earlier children become overweight, the higher the risk for development of obesity in adulthood. Both genetic endowments and shared environments are thought to play a critical role in the familial aggregation of obesity (10). Normally, a child's BMI increases throughout the first year of life, after which BMI declines until it reaches its nadir at 5-6 y of age (11) and then it begins to increase again until puberty (12). Whitaker et al. (11) showed that the timing of this nadir, or the beginning of the "adiposity rebound", was associated with the development of obesity in young adults. In their study, children with early adiposity rebound (i.e., <5 y of age) were at higher risk (OR= 4.9) for adult obesity as were children with a BMI z-score >0.05 at the adiposity rebound (OR=5.9) (11). This evidence indicates that higher body fat in the preschool years may influence obesity later in life. In Mexico, for example, 5% of children <5 y are overweight (8, 13) and the prevalence increases to 25% during the school-age years (5-11 y) (13).

1.2 Maternal obesity and child feeding practices[2]

There is evidence to suggest that maternal obesity affects child health through feeding practices. Data from observational studies in the early 1990's on breastfeeding determinants showed an inverse association between maternal obesity and breastfeeding practices (14). White American women were more likely to

[2] The WHO defines child feeding practices as the "whole complex of dietary, behavioral, and physiological processes involved in the child's ingestion of food" including breastfeeding and complementary feeding.

breastfeed if they weighed less before pregnancy, and breastfed longer if they gained less weight during pregnancy (15). "Heavy build/obese" American women were three times at risk for delayed onset of lactation (OR= 3.2, 95% CI: 1.5-6.7) (16). Australian women with a BMI >26 kg/m^2 in the first six months post-partum were at risk for cessation of breastfeeding (RR=1.50, 95% CI: 1.1-2.0) (17). Other factors that compromise lactation in obese women are higher incidence of preterm births and cesarean deliveries (16).

More recent epidemiologic studies, which have been designed to examine the association between pre-pregnant obesity and breastfeeding practices, have corroborated the earlier data on breastfeeding determinants. Pre-gravid obesity was associated with a 2-fold higher risk for discontinuing breastfeeding among rural white women in the U.S. (18, 19). Pregravid obesity in Hispanic women was also associated with shorter breastfeeding duration compared to their normal-weight counterpart (RR= 1.5, 95% CI: 1.1-2.1) (18). In one study, breastfeeding duration was 2 wk shorter in pre-pregnant obese American women, and excessive weight gain (above the Institute of Medicine recommendations for pre-pregnant BMI) during pregnancy was also associated with a shorter duration of breastfeeding by 1 wk (20). The relationship between maternal obesity and breastfeeding practices has also been demonstrated in Australian women (21, 22). In Danish women, Baker and colleagues (23) showed that compared to normal-weight participants, obese women gave birth to larger babies (156-g difference) and adopted different feeding patterns (shorter duration of any breastfeeding and earlier introduction of complementary foods). Consequently, their infants were 11% heavier at 1 y of age (23).

The shorter breastfeeding duration among obese women may impair weight regulation in both the mother and the infant. Researchers have shown that breastfeeding duration is inversely associated with maternal overweight (24, 25). In a

10-y follow-up study, women who breastfed >12 wk were 2 BMI units lighter than women who never breastfed (25). Among Brazilian women, 6 mo of predominant breastfeeding was associated with 1.75 kg weight loss in primiparous women and a 0.87 kg weight loss in women with ≥ 3 children (26). For infants, predominantly breastfeeding to at least 4 mo results in adequate linear growth (27) and a lean body mass (28). Moreover, there is evidence to suggest that breastfeeding, through self-regulation of intake (29), may help protect against obesity later in life (30), particularly among children born to obese mothers (20).

1.3 Mechanisms and links between maternal fatness and lactation: animal models and human research

There appears to be a biological mechanism that may explain the epidemiological association between maternal obesity and breastfeeding practice. There is limited data on hormonal or metabolic alterations in obese lactating women (14), so animal models have been used to elucidate the possible biological mechanisms. The data suggest that hormonal changes at parturition may lead to lactation failure (14).

Insulin resistance is a normal characteristic of pregnancy. To divert glucose to the products of conception, peripheral tissues become less sensitive to insulin (14). At parturition, insulin concentrations return to normal physiological ranges. Shaw et al. (31) reported that, unlike control rats, obese rats failed to normalize insulin levels by d 3 of lactation. It appears that prolactin values in the post-partum period are also adversely affected by maternal fatness. Prolactin is necessary for the synthesis of lactalbumin, a milk protein, and lactalbumin is necessary for the formation of lactose, a milk sugar comprised of glucose and galactose. The secretion of lactose into the lumen of the alveolus drives the osmotic gradient for milk secretion (copious milk production). In lean rats, there is a significant increase in prolactin concentration from

d 18 of pregnancy to d 3 of lactation while in obese rats this increase is blunted (31). In their human study, Rasmussen and Kjolhede (32) showed that prolactin response was lower in overweight/obese women 48 h after delivery than in normal-weight controls; although this difference may be attribute to infant suckling behavior (33). Insulin concentrations in overweight and obese women were 30-40% higher than normal-weight women, although the difference was not statistically significant. In obese mice, lactalbumin mRNA expression at d 1 of lactation is significantly reduced compared to control mice (34) . Milk volume in obese rats is also substantially reduced (35). The fact that obese rats are able to lose weight during lactation shows that obese rats mobilize macronutrient stores to support lactation (36). The data thus far indicate that in obese rats, higher insulin and lower prolactin concentrations may adversely affect glucose regulation or glucose uptake by the mammary gland, or both, and this leads to primary lactation failure.

Inadequate alveolar development may also contribute to delayed onset of lactation (14). Flint et al. (34) reported that obese mice have normal proliferation of mammary tissue such that the ductal structures invade the large mammary fat pad. However, at d 14 of pregnancy the development of the tissue was impaired as evidenced by reduced side branching frequency and alveolar development, which are important morphologic structures for milk synthesis. In obese mice at d 1 of lactation, the alveolar cell resembled the cell at d 18 of pregnancy in lean mice in that triglycerides had yet to be expelled into the lumen of the alveolus, a process which usually precedes the synthesis of lactose (34).

In addition to the biological factors, a myriad of other factors may also influence breastfeeding practices in obese women. These factors are mechanical (large breast, flat nipples), psychosocial (37) (self-efficacy, self-esteem, mental health), socio-cultural (poverty, social support), maternal behavioral (lifestyle, smoking, health

care, diet, physical activity), and infant behavioral factors (ability to latch on, rooting reflex, feeding cues) (38). In Denmark, where the social support for breastfeeding is strong, obesity is a risk factor for a shorter duration of full breastfeeding. Even in this context, the risk increases in a dose dependent manner from overweight (OR=1.07, 95% CI: 1.04, 1.10) to severe obesity (BMI ≥ 40) (OR=1.40, 95% CI: 1.21-1.63) (39).

Some of the effects attributed to obesity, however, may be related to infant behavioral factors, which are not routinely measured in these large epidemiology studies. For example, although infant breastfeeding behavior may not affect the onset of copious milk production (>72 h after birth), it does affect breastfeeding duration (37). Other factors that influence breastfeeding initiation and duration in obese White women include poor body image (37, 40), employment, and intention to breastfeed (37).

1.4 Fatness in Mexican women and the association to breastfeeding

In spite of the high prevalence of overweight and obesity in Latin American women, researchers have not systematically examined the association between maternal fatness and child feeding practices in Latin America. For numerous reasons, it is difficult to extrapolate the findings from the studies conducted in mother-child pairs living U.S. Australia, and Denmark. For example, obesity rates in Mexico have increased quite rapidly over a short period (5) so that obesity in these populations represents a shorter exposure to excess adiposity compared to women in developed countries; the implications of this are unknown. Moreover, researchers have shown that at the same body weight Hispanic women are fatter than White women. Casas et al. (41) showed that despite having the same body mass, Hispanic women have 5% more total body fat, with a higher proportion of fat mass in the trunk and arm areas than White American women. Because these Hispanic women were shorter, their BMI was higher at the same weight (41). Similarly, Thomas et al. (42) also showed that

Hispanic women have higher trunk fat, as evidenced by midaxillary skinfold thickness (0.57 mm, difference), than white women. These data may suggest that in women of Hispanic ethnicity, the negative effects of overweight on lactation may be apparent at lower BMI values because of differences in amount and distribution of body fat.

Child feeding practices, which by definition include breastfeeding and complementary feeding practices (43), are in large part driven by cultural and contextual factors. Thus, there is a need to examine maternal fatness and child feeding in Latin America. We know, for example, that Mexican women breastfeed for extended periods (44), and this behavior is probably driven by a combination of factors, such as positive attitude towards breastfeeding, advice from family members and physicians (45), poor availability and high cost of infant formula or powdered cow's milk. We do not know if this feeding pattern differs by maternal weight status. Data from studies on breastfeeding determinants in Mexico suggest an inverse relationship between maternal obesity and breastfeeding. Maternal overweight (BMI $\geq$25 kg/m^2) was associated with a shorter duration of breastfeeding (8 vs. 10 mo) and significantly lower rates of exclusive breastfeeding at 6 mo (15% vs. 25%), although the data were not adjusted for wealth or education (44). Unadjusted data from another study showed that a high BMI at 1 wk post-partum was associated with perceived milk insufficiency (46) and with poor breastfeeding practices at 2 mo (47). In Mexico, perceived milk insufficiency is commonly given as a reason for terminating breastfeeding (45).

1.5 Child feeding practices in Mexico and contextual factors.

Mexican women are knowledgeable about the benefits of breastfeeding (45). Yet, they transition relatively quickly from breast milk to other milks and foods. 92% of women report having breastfed their newborn, but only 20% report exclusive breastfeeding at 6 mo (44). By 3, 5, and 6 mo of age 50% of infants have received

non-human milk, cereal-based nutritive liquids, and cereal, legumes and animal protein, respectively (48). By 9 mo, only 50% of women are still breastfeeding (44). Among low-income Mexican women, complementary feeding practices are poor in that animal-source foods, cereals, and legumes are not provided regularly to the child by 9 mo (48).

Poverty is expected to be the major influence on feeding practices and dietary adequacy (48) but other cultural and psychosocial factors, such as perceived barriers, facilitators, and beliefs, affect feeding practices (45, 49, 50). How these pieces fit together has not been investigated and thus knowledge regarding child feeding remains fragmentary. To capture more clearly how child feeding unfolds in the context of everyday lives, studies that aim to understand the maternal perspective on feeding children are urgently needed.

In Mexico, researchers have shown that the fruits and vegetables offered as first foods reflect what the mother had consumed during pregnancy or lactation (51). Mothers play a critical role in establishing good eating practices (10). Food preferences (likes and dislikes) are molded early childhood and maternal food preferences may influence food exposures. In a longitudinal study of White American toddlers, Skinner et al. (52) reported that foods liked at age 8 y were those same foods liked at 2-3 y, and if a mother disliked a particular food, the child was more likely to never have tasted that food.

Because the Mexican diet has undergone marked changes since the mid 1980's, we do not know to what extent these dietary shifts may also impact the diets of young children. Mexican adults consume a diet that is high in refined carbohydrates, carbonated beverages and fat, with low intake of fruits and vegetables, dairy products, and meats (53). This is mirrored by the diet of young children where 27% of their total energy come from modern processed food stuffs and 12% of their total carbohydrate

intake comes from carbonated beverages (54). Maternal diet may also be a proxy for a shared food environment where eating behaviors are learned. For example, young children will eat more food when served larger portions (55, 56). Eating in the absence of hunger is a shared behavior among siblings (57). Young children who eat quickly (mouthfuls/min) at 4 y had higher BMI at 6 y (58). At 7 y, children were likely to be heavier if their mothers were overweight and obese and had exhibited a restrictive feeding style (59).

Data on complementary feeding behaviors and the family food environment have been limited to middle- and upper-class families in the U.S. and U.K. Most of the work around maternal-child eating behaviors in developing countries has focused on responsive feeding, which broadly defined is the interaction between a mother and the child at a feeding episode (60). The behavioral studies in the U.S. and U.K. and the responsive feeding literature in developing countries have not examined in detail the various processes that shape the maternal-child food relationship, which is necessary if one is to understand when and how mothers can mold eating behaviors, food exposures, and the quality of the complementary diet.

1.6. Theoretical perspectives and the nature of inquiry

We can define science as the systematic discovery of knowledge (i.e., what is true) about phenomenon. But questions about what is knowledge and how we know knowledge and the approaches (i.e., goals and procedures of inquiry) used to acquire knowledge are philosophical questions contained in the concepts of ontology, epistemology, and methodology, respectively. These philosophical considerations are part of a paradigm (i.e., world view), defined as "the nature of the world, the individual's place in it and the range of possible relationship to that world and its parts" (p. 107) (61). All scientists have and work within a particular paradigm. Because paradigms represent a set of beliefs, which cannot be falsified or proven

correct, to assert the use of one paradigm over another, scientists must argue persuasion and utility rather than proof to support their position (61).

As a field of study, nutrition lies at an interface of the biological and social sciences. The post-positive paradigm is the predominant theoretical perspective in nutrition. Post-positive researcher begins with a theory (or conceptual framework), and data is gathered to support or refute it, and then changes are made to the theory. In this paradigm, a reality is assumed to exist but reality is conjectural as researchers will never really know the absolute truth (61). Scientists will often assume an objectivist stance, completely independent of the phenomenon under study. Methodologically, Guba and Lincoln (61) argue that post-positivists strive for "critical multiplism" (i.e., triangulation) and are concerned with falsifying hypotheses. Qualitative methods are included to understand reality and knowledge and therefore inquiry is conducted in more natural settings, the participant's point of view is solicited, and grounded theory is used (61).

The interpretive paradigm offers a humanist construction of the world, and is often argued by its proponents to be more useful for studying human behavior. Philosophically, researchers working within this perspective are concerned with understanding meaning and defining the situation as the actor sees it (62), and thus reality is relative (61) and actions are intersubjective (i.e., language and descriptions of situations are constitutive of institutions and practices) (62). Lincoln and Guba (61) explain that it is not about the veracity of the constructions but simply about how informed or sophisticated these constructions are. Schweizer (63) notes that interpretivists adequately capture the idea of empathetic understanding, which he considers as a "procedure for finding out what other people think and feel and how their subjective (but to a certain extent shared) beliefs structure meaningful action" (p. 61) (63). Interviews, observations, and archival research are used to grasp meaning;

data analysis is interpretive and dialectical. To understand meaning, the researcher must interpret it, and so she and the participant interact in a way that uniquely creates the "findings" (61). Multiple methods are used to increase the completeness of the findings rather than for triangulation (64). Seaton (64) explains that data "are not expected to verify or confirm previously acquired data…but to maximize the richness of the findings." (p. 195). Interpretivism can be used to capture multidimensionality of human behavior, bounded by time and history.

Mixed-methods was proposed as the 'third' paradigm to bridge the positivist and interpretivist divide (65). Some have argued a mixed-methods approach is post-positivist research, albeit tempered (61). The scholarly debate is quite lengthy (63, 64), but the gist of the argument rests on the ways that researchers have stripped away the interpretive perspective from qualitative methods, and ultimately subordinated them to a post-positive world view. This has lead to mixed-methods research that is focused on finding the correct answer that lies in an objective world while considering context and acknowledging that the appropriate choice of methods will ultimately lead us to the truth.

1.6.1 Ethnography and the biocultural framework

Ethnography is a methodological approach. It is, as Spradley (66) notes "the work of describing culture" (p.3) and culture is the "is the acquired knowledge that people use to interpret experience and generate social behavior."(p. 5) (67) Researchers use ethnography to build a systematic understanding of human behavior by studying behavior in the context in which it occurs (66). Ethnography allows for the discovery of meaning and interpretation of social action.

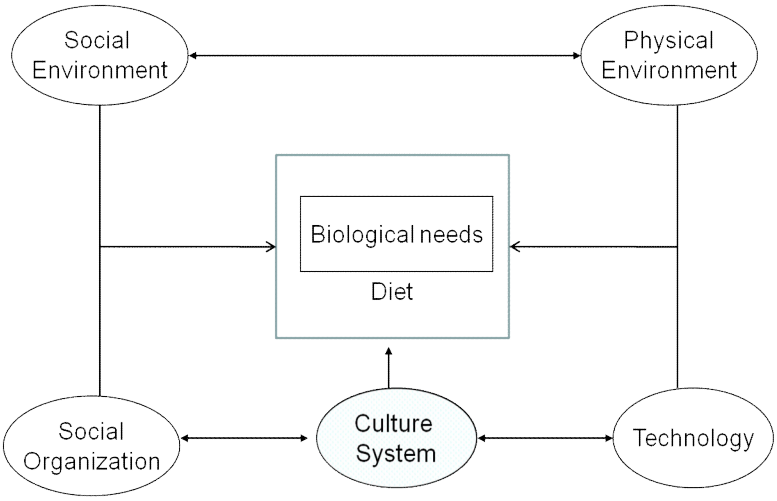

Figure 1.1 The biocultural framework. Redrawn from Jerome, Kandel, and Pelto (69).

In the study of culture, knowledge encompasses beliefs, rules, ideas, and concepts (67). These terms are often used interchangeably. Viewing knowledge this way allows the researcher to build a system of meaning around a cultural phenomenon. Knowledge can be explicit or tacit (not verbalized). Tacit knowledge is gleaned by observing behavior. In public health, knowledge is often regarded as knowing "facts" about a health issue, for example "facts about healthy eating". In ethnography, knowledge is all the necessary information needed to generate behavior (67).

Ethnography is best conducted when it is guided by theory (68). The biocultural framework, developed in the field of nutritional anthropology, has its roots in ecological perspective (69), which seeks to examine the interaction between humans and their environment (70) and gives primacy to both biological and cultural factors for explaining human behavior (69) (Figure 1.1).

This dissertation is mixed-method in that I employ two different world views for my inquiry on child feeding practices. I have explicitly chosen not to mix the two methods, as can be done using a more traditional mixed-methods approach (71). Instead, and in light of the scholarly debate, I have attempted to keep each world view bound into different sections of this dissertation.

1.7 Conceptual Framework

This dissertation will examine two main issues: (a) the association between maternal fatness and child feeding practices; (b) the maternal knowledge/ beliefs about child feeding that guide feeding practices while situating the practices within the household food environment. These issues and the factors considered in the subsequent chapters are presented in the conceptual framework (Figure 1.2). The rationale for this framework is presented below.

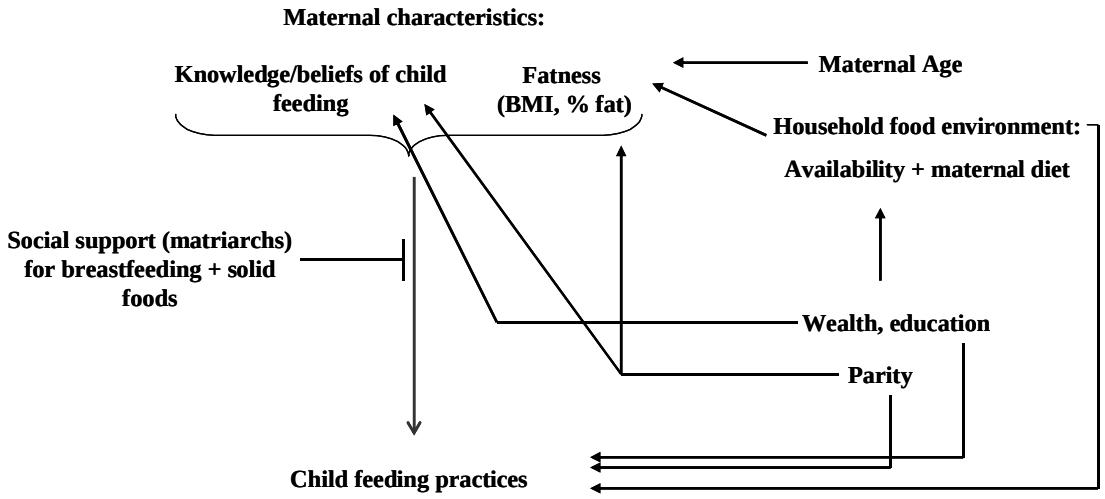

Figure 1.2. Factors influencing the relationship between maternal characteristics (fatness and knowledge) and child feeding practices.

Factors that influence the relationship between maternal fatness and child feeding practices. Older women are more likely to be heavy and have children. Parity influences maternal weight through post-partum weight retention and child feeding practices through feeding experience. Wealth improves household food availability, which can lead to a more varied diet for both the mother and the child. Wealth increases the access to specialty child products such as infant formula, cow's milk, specialty yogurts, and other manufactured infant foods (i.e., Gerber). Women with higher education may have access to general nutrition knowledge, through reading or schooling, that can influence maternal weight and child feeding.

Factors that influence maternal knowledge/beliefs. Knowledge and beliefs are used interchangeably as noted. Both terms refers to her concepts about feeding children, healthiness (i.e., food, illness) or eating behaviors (e.g., eating on schedule, feeding on demand, etc.). Wealth may influence access to information or provide a different social environment that may change mother's knowledge of child feeding. Similarly, education can improve access to nutrition knowledge and thus change maternal beliefs and perceptions about appropriate foods and eating behaviors. Education may improve self-efficacy and lead to fewer perceived barriers. Parity via previous feeding experience can influence maternal concepts of child feeding. Maternal beliefs regarding child feeding may not be realized in practiced if matriarchs offer specific advice on how to feed children. Thus, social support can moderate the relationship between knowledge and practices.

2. Aims of the dissertation

The aims of the dissertation were to (a) examine the association between maternal fatness and child feeding practices from 0-2 y; (b) examine the

conceptualizations and practices of child feeding among a group of low-income Mexican women, considering especially the link between the child's diet and the maternal diet within the broader household food environment. Underlying these two aims are distinct theoretical and methodological considerations.

For the first aim, I used a cohort of mother-child pairs that had participated in a randomized supplementation trial in Xoxocotla, a small semi-urban community in Morelos, Mexico. In Chapter 2, I address this first aim through epidemiology. I examine the association between maternal fatness, as captured in BMI and percent body fat, and the duration of full and any breastfeeding as well as dietary diversity and child feeding practices as assessed in an index score. Survival analysis, regression, and random coefficient models were used to test for associations between variables.

For the second aim, I used ethnography to broaden the scientific inquiry (72) and reveal maternal knowledge of complementary feeding as well as the underlying dynamics of child feeding. I interviewed 31 women who lived in Xoxocotla, Morelos. I inquired about maternal perceptions of the child's behavior, age of introduction of foods, types of foods prepared for the family, types of food items purchased and where they were purchased, and maternal activities. Home observations were used to add richness to my interview data as well as to explore the environments where child feeding occurs. In Chapter 3, I addressed the following research question: what is the underlying maternal knowledge (i.e., concepts) that guides child feeding practices in this community? The data revealed novel insights about the complexity and systematicness of this knowledge and its embeddedness in household-level factors.

In Chapter 4, I examined the links between the maternal diet and the child's diet within the context of household food environment. I went back to the data to look specifically for the ways the maternal diet was linked to what the child's diet (by examining differences and similarities), shared meals, eating between meals, and

maternal considerations about what foods to prepare for the infant or young child. Chapter 4 reveals that the interconnections between the maternal diet and complementary diet is complex and considers money, food preferences of the family members, and the presence of family members for meal times.

In Chapter 5, the concluding chapter, I provide a synthesis of the results from the previous chapters. I also take a step back and examine how my results can provide insights on the co-occurrence of malnutrition with over-nutrition in women and children. I also consider the broader social construction of the Mexican diet and the world-historical questions nutrition researchers could ask when they study dietary changes and dietary inequalities.

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Chapter 2

The association of maternal fatness with breastfeeding and child feeding practices in Mexican children from 1-24 mo.

Abstract

Maternal prepregnancy obesity is associated with shorter duration of any and full breastfeeding (BF). Despite the high prevalence of maternal overweight and obesity in Mexico, this association has not yet been investigated. The aim of this study was to examine the association of prepregnancy fatness [body mass index (BMI) and percent body fat] and duration of any and full BF, dietary diversity (DD) using the WHO DD indicator, and child feeding practices by constructing a child feeding index (CFI) that included breastfeeding, complementary foods and other behaviors. We used longitudinal data from mother-child pairs (n=370) in Morelos, Mexico. We used survival analysis to examine the associations of prepregnancy fatness and BF duration and linear regression to examine DD and CFI. Prepregnancy BMI was not associated with duration of any and full BF. DD scores improved from 6-24 mo while CFI scores decreased from 1-24 mo. BMI was not associated with DD. BMI interacted (p=0.07) with child age; higher maternal BMI was associated with a lower decrease in CFI scores over time. In this sample of low-income Mexican women, maternal fatness did not significantly influence breastfeeding duration, dietary diversity, or child feeding practices, as measured by our CFI index, from 1-24 mo.

2.1 Introduction

Maternal prepregnancy obesity is associated with poor breastfeeding (BF) outcomes among White and Hispanic women in the U.S. (1, 2) and in women in Denmark (3) and Australia (4, 5). Women who are obese before pregnancy are more likely to abandon exclusive, full, and any BF sooner than their normal-weight counterparts (2, 6). Among Danish obese women, cessation of BF is associated with earlier introduction of complementary foods, which translated into higher infant weight at 1 y (3). These findings have serious implications for infant and young child nutrition in countries where a large proportion of women of childbearing age are obese.

Despite the exceedingly high prevalence of maternal overweight (36%) and obesity (35%) in Mexico (7), epidemiological studies have not been designed to investigate the relationship between maternal pre-pregnancy BMI and BF practices. Cross-sectional data on breastfeeding determinants shows that overweight Mexican women (BMI >25 kg/m^2) were less likely to report exclusive BF at 6 mo (15% vs. 25%) and reported a shorter duration of BF (8 vs. 10 mo) compared to normal-weight women (8). Perez-Escamilla et al. (9) noted that a high BMI at 1 week post-partum was associated with perceived milk insufficiency and with poor BF practices at 2 mo post-partum in Mexican women (10).

Compared to normal-weight women, obese women encounter unique biological and mechanical difficulties that may precipitate their decision to initiate and/or continue BF. These decisions are also affected by psychosocial and socio-cultural factors.

In human studies, the prolactin surge in obese subjects is blunted while insulin levels remain elevated in the days following delivery (11). Similar hormonal alterations were observed in obese rats (12). Obese mice have inadequate development

of the mammary tissue during pregnancy (13) and reduced lactalbumin mRNA expression (13) and milk volume (14) after delivery. Obese women are more likely to have large breasts and flat nipples which make it difficult for the infant to establish a good latch. A good latch is needed to establish copious milk production (15). In the psychosocial arena, Hilson et al. (16) found that shorter duration of breastfeeding among obese women was associated with dissatisfaction with their physical appearance, an indifference towards breastfeeding, and shorter planned duration of breastfeeding.

Breastfeeding and child feeding patterns are also influenced by the broader social-cultural context (17). Obese women in the United States breastfeed for much shorter periods (50^{th} percentile for any BF duration: 15-30 days) (2, 18) compared to obese women in Denmark (50^{th} percentile for any BF duration: 21 wk) (6). Breastfeeding is often complemented by formula use in the United States compared to solid foods in Denmark where formula feeding is less common. In Mexico, 92% of women report BF at birth and 42% are still BF at 12 mo post partum (8). Low-income Mexican women introduce complementary foods at about 5 mo of age (19). At 9 mo, however, 25% of low-income Mexican children do not regularly consume cereals, legumes or animal food products including non-human milk (19).

Inasmuch as diet is a determinant of weight, maternal fatness may also be a proxy for the household food environment. It is plausible that obese women have access to a greater variety of food in the home. Recently, in the UK, researchers showed that mothers who consumed a healthy diet were more likely to provide their infants a complementary diet rich in fruits, vegetables, and home-prepared baby foods (20). In that study, maternal BMI was a predictor of complementary diet quality at 6 mo, but the effect of BMI had disappeared at 1 y. Given that obese women may start feeding solid foods sooner than normal-weight women (3), it is important to consider

if maternal fatness in this context may affect the diversity of the complementary diet.

Previous studies have focused on breastfeeding patterns without considering the full complementary diet. One approach is to use an index to link breastfeeding and the complementary diet. The index can also be used to examine a series of feeding practices over time could potentially be linked to maternal fatness, such as use of bottles and sweetened beverages.

The aim of this study was to examine the association between pre-pregnancy maternal fatness, dietary diversity, and child feeding practices in a cohort of Mexican mothers and their children from 1 to 24 mo of age. We hypothesized that a) pre-pregnancy maternal fatness would be negatively associated with the duration of full or any BF and b) maternal fatness would be positively associated with dietary diversity and negatively associated with child feeding practices as assessed by a child feeding index.

2.2 Methods

Description of the original study. The dataset used for this analysis was from a randomized, double-blind micronutrient supplementation trial among pregnant women and their offspring. The trial was carried out by researchers from the Mexican National Institute of Public Health and Emory University between January 1998 and December 2000 in a small semi-urban community in the state of Morelos, Mexico. In the pregnancy supplementation trial, 1113 pregnant women were randomized to receive one of two supplement regiments (iron-only vs. multiple micronutrient) daily from as early as possible (<13 wk) and delivery. Data was collected on birth outcomes (i.e., birth weight and preterm delivery), infant growth up to age 3-mo, and infant feeding practices at 1 and 3 mo. Women were eligible for the intervention trial if they were less than 13 wk pregnant at enrollment and were not taking a micronutrient supplement. Women with severe anemia were excluded as well as

women with pathologies or complications of pregnancy (21). Twin infants or infants born with congenital anomalies were excluded from the analysis.

Starting March 1999, participants in the pregnancy supplementation trial were invited to enroll their 3-mo-old offspring in a subsequent child micronutrient supplementation trial in which children were randomized to receive one of two supplement regiments (iron-vitamin A vs. multiple micronutrient) from 3-24 mo of age. All children born after January 1999 were eligible to participate in the child supplementation trial unless they were a twin, born with congenital abnormalities or if taking supplements. The child supplementation trial was completed in December 2002. Data on infant and young child feeding practices was collected at each follow-up period: 1, 3, 6, 9, 12, 18, and 24 mo. Of the 906 live births reported in the pregnancy study, 660 were eligible for the child supplementation trial.

Eligibility criteria for inclusion in our secondary analysis were (a) delivery of a healthy, full-term infant on or after January 1, 1999, (b) subsequent enrollment of the infant into the child supplementation trial, and (c) maternal age $\geq$ 16 years. Of the 906 live births available from the pregnancy trial, 246 (27%) births occurred before January 1999, 1 (0.01%) was preterm (<37 wk gestation), 34 (4%) were LBW (<2.5 kg), 82 (11%) mothers refused to participate in the child supplementation trial, and 23 (2%) women were younger than 16 year old. We could not determine eligibility status of 110 (12%) mother-child pairs due to missing information and thus they were considered ineligible. Premature and LBW were ineligible as they are less likely to initiate breastfeeding and would have different feeding trajectories later in life. Women younger than 16 years old were ineligible because other caregivers in the household would be more likely to control child feeding practices.

After removing those ineligible, there were 410 (45%) mother-child pairs eligible for our analysis. We excluded from these 410 women all those women without

a weight in the first trimester of pregnancy (n=28, 7%), which we used as a proxy for prepregnancy weight. Because some women contributed more than one pregnancy, we excluded the younger sibling (n=12, 3%). Loss to follow-up over the 24-mo observation period of the 370 children included in our analysis was 51% (n=189) (see Appendix Figure 1A).

2.2.1 Creation of variables

Wealth. A measure of household wealth was created by considering household construction (i.e., floor, roof, walls, water, sewage, electricity, and bedrooms) and possessions (i.e., car, TV, washer, refrigerator) and smaller household items (i.e., radio, blender, sewing machine) as well as type of cooking fuel (gas or wood) and location of kitchen (indoor or outdoor). We conducted a principal factors analysis and retained the first factor as it explained 74% of the common variance. We computed Chronbach's alpha to test how well the 18 items belonged together. The wealth score had an alpha of 0.70.

Maternal fatness. Body mass index (BMI, kg/m^2) was used as a measure of fatness. Weight and height were measured at study enrollment using standardized procedures. Because weight gains in the first trimester are usually less than 2 kg (22, 23), we used weight taken between 4 wk to 12 wk of gestation as a proxy for pre-pregnancy weight. BMI was used as a continuous variable in the models to avoid potential misclassification of women into exposure categories. As a check on the data, we ran the model with maternal weight adjusted for height and obtained similar results to BMI (data not shown).

Body fat was estimated using a predictive equation derived from a sample of rural and urban Guatemalan women, which was similar to our sample in age range, BMI, and waist circumference (24). The researchers in that study used hydrostatic weighing as the standard to validate their equation. The equation considers weight,

height and abdominal circumference to predict percent body fat [% body fat = 19.420 + (weight x 0.385) – (height x 0.215) + (abdominal circumference x 0.265)]. Body fat was calculated only for women with available waist circumference measure (n=251, 62%). We ran all statistical models with BMI and body fat. Because we obtained similar results with both independent variables, we only present the data on BMI here as this allows comparison to the data in the literature. Models using body fat are presented in the appendix.

Child feeding index. Data on feeding practice was collected using two different instruments—an infant-feeding questionnaire with yes/no responses at 1-9 mo of age and 24-h dietary recalls collected on 2 non-consecutive days for visits between 12-24 mo of age. The infant feeding questionnaire provided general information about categories of foods and beverages consumed as well as use of cups or bottles for infant feeding. For example, at each follow-up, mothers were asked if they had provided cow's milk. Responses then capture behaviors that occurred between follow-ups and not what was consumed in the previous day. After 12 months of age, only information on specific foods and amounts consumed was available from the 24-hour recall.

We constructed an age-specific child feeding index (CFI) based on best practices outlined in the World Health Organization (WHO) *Guiding Principles for feeding the Breastfed Child* (25) and the WHO Core Indicators (26). Behaviors in the CFI were scored on a bipolar scale, -5 to + 5. The scores are arbitrary but the intention is to show that certain practices are more beneficial to child health and therefore receive a relatively higher positive score (e.g., exclusive breastfeeding from 0-6 mo), while others are detrimental and receive a relatively lower negative score (e.g., use of bottles).

Rationale for CFI sections and scores.

The index was partitioned into three sections: breastfeeding, other feeding behaviors (e.g., use of bottles, use of sweetened beverages); and complementary foods (Table 2.1).

Breastfeeding. Exclusive BF[3] was scored the highest, followed by full BF[4] and then any BF. Fewer than 2% of women reported feeding powdered cow's milk.

Bottles. Use of bottles is considered a negative practice because these are difficult to keep clean and therefore can increases risk of diarrheal disease. We were only able to score the use of bottles from 1-9 mo because the 24-h recall did not include information about feeding utensils.

Sweetened beverages. The use sweetened beverages was permitted among the fully breastfed infants on the assumption that these beverages will not significantly displace breast milk if infants are breastfeeding on demand. Among partially breastfed infants, however, the use of sweetened beverages was a negative practice on the basis that these were not the nutrient-dense beverages needed for growth. From 0-9 mo, the sweetened beverage category was comprised of tea or water with sugar, any type of fruit juice, or milk with sugar. From 12 mo, due to more complete information, this category included sugar and chocolate added to beverages; carbonated beverages were in a separate sub-category, and 100% unsweetened fruit juice was categorized as fruit, but other types of juice were considered sweetened beverages.

Complementary foods and dietary diversity. Feeding solids at 1 and 3 mo was considered an inappropriate practice as young infants are not developmentally ready to receive these.

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[3] Exclusive breastfeeding was defined as no other liquids or solids given to the child

[4] Full breastfeeding was defined as breast milk provided along with liquids such as water, juice, tea, broths.

At 6 mo and beyond, the recommendation is that dietary staples, animal-source foods (ASF), fruits and vegetables should be consumed daily, provided that the foods are given in the appropriate consistency for the child's age (25). Sufficient dietary diversity is likely to provide the young child with the nutrients needed to ensure good health and growth (27). To assess dietary diversity we used a modified version of the WHO Dietary Diversity indicator (26). Our indicator differs from the WHO in that we could not separate fruits and vegetables by their vitamin A content as this information was not available from 1-9 mo.

Table 2.1 Feeding behaviors and points in the Child Feeding Index.

Behavior	**1-3 mo**	**6 mo**	**9 mo**	**12-24 mo**
Breastfeeding				
Exclusive breastfeeding	Yes= 5 No= 0	Yes= 5 No= 0	N/A	N/A
Full breastfeeding	Yes=4 No=0	Yes=4 No=0	N/A	N/A
Any breastfeeding	Yes = 2 No= 0	Yes= 2 No= 0	Yes= 5 No= 0	Yes = 5 No = 0
Use of bottle or syringe	Yes= -5 No= 0	Yes= -5 No= 0	Yes= -5 No= 0	N/A
Sweetened beverage	Yes= -2 No= 0	Yes= -2 No= 0	Yes= -2 No= 0	Yes= -2 No= 0
Carbonated Beverages	N/A	N/A	N/A	Yes = -3 No = 0
Complementary food [a]	Yes = -3 No = 0	0-7	0-7	0-7
Max points	-10 to 5	-7 to 9	-7 to 12	-5 to 12

[a] based on the dietary diversity score.
N/A: not applicable; item not available in questionnaire or no women reported the behavior

We left fruits and vegetables as separate categories. The seven groups scored were grains/tubers[5], fruits, vegetables, legumes[6], egg, flesh foods[7], and dairy[8] (i.e., cheese, cow's milk and infant formula, yogurt). Categories were scored if the mother ever reported feeding a food belonging to that category. For cases were mixed dishes were used, individual food components were scored. For example, a child who ate a tortilla, a piece of bread, an apple, and chicken meat in the previous day would receive a score of 3. The food scores were summed for each follow-up visit after age 6 mo. The theoretical range in scores at each time point was between 0 and 7. The final score was based on the average of the two consecutive dietary recalls for each age ≥12 mo.

Child feeding index construction and manipulation. The dietary diversity (DD) score was included as the complementary food component of the CFI. Because the range in CFI score was different at each time point, we took the range in scores and scaled it from 0 to 10 to allow for comparisons over time. For instance, at 1 mo our theoretical range was -10 to 5. A child with -8 total points received a score of 1.3 on our final scale and a child with 5 total points scored 10 on the final CFI scale.

2.2.2. Description of data analysis

We used independent-sample *t* tests to assess differences in means and Mann-Whitney U test for interval variables that were skewed. Chi square test was used to assess differences in frequency.

Survival analysis. To test the hypothesis that prepregnancy fatness would be associated with shorter duration of full and any BF we used survival analysis. This analysis is well suited to deal with censored data, where the event is never observed because subjects drop out or the follow-up period ends before the event occurs. The

[5] From 1-9 mo, rice and tortilla only.
[6] From 1-9 mo, beans only.
[7] From 1-9 mo, fish consumption was not asked.
[8] From 1-9 mo, yogurt consumption was not asked.

conventional survival methods, Kaplan Meier or the Cox proportional hazard models, both of which assume continuous data, are not suitable for our data for two reasons: the data is interval censored (i.e., we do not know the exact time when the event occurred), so many children share the same survival times (28); and the time intervals vary in lengths (3- vs. 6-mo intervals), which complicate the interpretation of the estimates across the intervals (28). The complementary log-log (clog-log) model is a discrete analogue of the continuous proportional hazard model, and the interpretation of the beta coefficients is similar to hazard ratio[9] (28). We used clog-log models to examine time until termination of full (when the child was first provided other milks or food) and any breastfeeding (when a child stopped breastfeeding altogether). To detect a 1-mo difference (SD=1.5) in any BF duration between normal-weight and overweight women, we required 40 women in each group, which were available.

Multiple linear regression and mixed models. To test the hypothesis that maternal fatness was associated child feeding practices and dietary diversity, we first examined the data using multiple linear regression at each follow-up visit. We checked the residuals for normality assumptions. We regressed CFI scaled score on BMI and then included the potential confounding factors. We used the same procedure for the DD score. We also ran the models with body fat as the predictor (see appendix).

It was possible that BMI might affect CFI or DD score differently over the 24 mo, so we used mixed models to examine interactions between BMI and child age. We also examined interactions between child age and maternal education and wealth. We first fitted a random intercept model followed by a random coefficient model with child age as the random slope. We modeled the main effects and then the interactions.

Confounding. Confounding variables were those covariates that could be

[9]The hazard is estimated using the following equation:

$$\lambda_{ij} = 1 - \exp(-\exp(\alpha_j + \beta' x_i))$$

unequally distributed in the exposure group and are predictors of child feeding practices: education (≤ 6 y, >6 y), wealth, multiparity (0 vs. ≥ 1), maternal age at baseline, and indigenous ethnicity. We also controlled for the mother and child supplementation group assignment.

All analyses were done using Stata (v 10 StataCorp, College Station, TX). We considered $p<0.05$ as statistically significant, and interactions significant at $p<0.1$.

2.3 Results:

The mother-child pairs included in the analysis (n=370) did not differ from those excluded from the analysis (n=38) on confounding variables (Appendix 2.1A.). Women who dropped out (n=189) were younger (22.6 ± 4.2 vs. 24.2 ± 5.3, $p<0.001$) compared to those that completed the study. The most cited reasons for dropping out were 'mother did not want to participate anymore' (n=60, 32%), 'husband did not want his wife to participate' (n=39, 21%), 'the child did not like the supplement' (n=23, 12%).

In our sample, 91% of the women were housewives, 76% had at least 6 y of education, and 39% had delivered via c-section. At least 30% of the women were primiparous and another 30% had one child. The majority of the obese women were multiparous (85%, $p=0.024$) and were older by 3.6 y ($p<0.001$) compared to the non-obese women (Table 2.2).

BMI and body fat. The BMI range was 17.3 and 45.1 kg/m^2. Mean BMI was very close to the cut-off for overweight. BMI and waist circumference were highly correlated ($r^2=0.86$). A small proportion of our sample was obese as classified by BMI ≥ 30 kg/m^2 and 16% (n=41) had abdominal obesity (waist circumference >88 cm). Mean body fat was 30%.

Table 2.2 Selected baseline characteristics of mother-child pairs included in the analysis. [1]

Characteristic	Included (n=370)
Mother	
Parity, *n*	1 (0, 11)[1]
Maternal age, *y*	23.7 ± 5.1[2]
Wealth	-0.04 ± 0.9
Weeks pregnant, *wk*	8.5 ± 1.8
Education, *y*	6 (0, 16)
People in home, *n*	5 (1, 23)
Indigenous ethnicity	30%
Married	70%
Vaginal delivery	60%
Weight, *kg*	54.7 ± 9.8
Height, *cm*	148.5 ± 4.9
Waist circumference, *cm*	78.9 ± 8.9
Body fat, *%*	29.9 ± 5.8
BMI, kg/m^2	24.4 ± 4.1
Underweight (<18.5 kg/m^2), *n*	14 (4%)
Normal weight (18.5-24.9 kg/m^2), *n*	207 (56%)
Overweight (25.0-29.9 kg/m^2), *n*	116 (31%)
Obese (≥30 kg/m^2), *n*	32 (9%)
Child	
Birth weight, *kg*	3.1 ± 0.3
Gestational age, *wk*	39.8 ± 0.7
Sex, *girls*	43%

[1] Median and range; [2] mean ± SD.

Breastfeeding, milk feeding, and introduction of food between 1 and 6 mo

(Appendix Table 2.2 A). Exclusive BF was reported by 32% (n=114) of the women at 1 mo, and this fell to 14% (n=50) at 3 mo. In contrast, full BF was reported by 81% (n=281) of the women at 1 mo and 77% (n=271) at 3 mo. The proportion of women still BF at 1 and 3 mo remained high (~97%).

At 1, 3, and 6 mo, 16% of the women reported using infant formula (n for each month: 53, 57, and 49, respectively) (Appendix Table 2.2 A). Early introduction of food was uncommon. Only 7% women (n=24) had reported giving food at 3 mo. At 6 mo, 75% had reported the use of solid food (n=232). Cessation of full BF in this sample was attributed to infant formula at 1 and 3 mo, and to solid foods at 6 mo.

About one-third of women reported using bottles at 1 and 3 mo, over half did so at 6 mo. The use of syringes for feeding was not common. By 9 mo, only 30% reported using bottles. Use of sweetened beverages was infrequent from 1-6 mo (< 3%), but increased to 63% (n=208) by 9 mo. The use of carbonated beverages increased through the second year of life, from 29% at 12 mo to 56% at 24 mo.

Hazard estimates from clog log survival models. BMI was not significantly associated with the hazard of stopping any and full BF (Table 2.3). The adjusted hazard estimates at each follow-up are shown in Figure 2.1 and show that, on average, the risk for terminating any BF occurred after 12 mo, but was low throughout 1-24 mo. Results did not vary when body fat was the predictor (Appendix Table 2.3A).

Dietary Diversity. On average and as expected, women fed foods from more food groups as the child grew older (see appendix Table 2.4A). At 6 mo, 60% of the women reported feeding fruits, 20% grains, and 12% vegetables. At 9 mo, 68% had fed grains, 70% fruits, and 30% vegetables. In the second year of life, grains were the dietary staple: 83% of women fed grains at 12 mo and 96% at 18 mo and 98% at 24 mo. In the second year, about two-thirds of the women reported feeding fruits compared to less than 6% who fed vegetables.

Table 2.3 Hazard ratios for termination of full and any breastfeeding.

Variables	Full breastfeeding Hazard ratio (95%CI)	P-values	Any breastfeeding Hazard ratio (95% CI)	P-values
Month[1]				
3	0.74 (0.50, 1.11)	0.15	0.43 (0.11, 1.67)	0.22
6	7.32 (5.41, 10.0)	<0.001	0.76 (0.24, 2.41)	0.64
9	12.23 (8.21, 18.46)	<0.001	1.31 (0.47, 3.10)	0.60
12	-		1.62 (0.58, 4.48)	0.34
18	-		10.76 (4.76, 24.32)	<0.001
24	-		13.51 (6.02, 30.29)	<0.001
BMI, kg/m^2	1.01 (0.98, 1.04)	0.34	1.00 (0.95, 1.05)	0.93
Maternal age, *y*	0.99 (0.97, 1.02)	0.54	0.97 (0.93, 1.02)	0.35
Multiparity [2],	0.92 (0.67, 1.23)	0.59	1.36 (0.82, 2.27)	0.22
Education [3], *≤6y*	0.84 (0.65, 1.10)	0.20	0.93 (0.62, 1.40)	0.75
Indigenous ethnicity [4]	1.17 (0.89, 1.53)	0.24	0.80 (0.50, 1.27)	0.35
Wealth score	1.07 (0.92, 1.24)	0.34	0.97 (0.76, 1.24)	0.80
Child supplement [5], *MMN*	1.05 (0.82, 1.33)	0.68	1.32 (0.87, 1.98)	0.17
Mother supplement [6], *MMN*	1.07 (0.84, 1.36)	0.57	1.46 (0.98, 2.18)	0.059

[1] 1 mo was the reference group; Reference group: [2] primiparity; [3] ≥ 6y; [4] non-indigenous; [5] Fe-Vit A group; [6] Fe group.

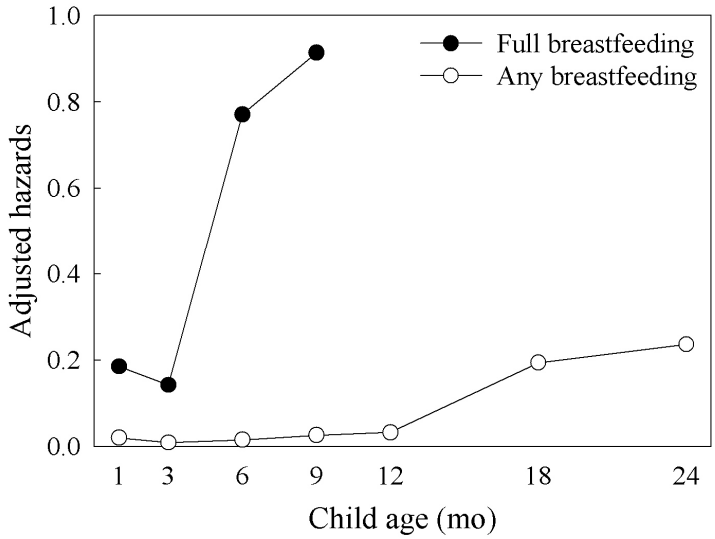

Figure 2.1. Adjusted predicted hazard estimates for full and any BF over follow-up. Adjusted for maternal age, multiparity, education, indigenous ethnicity, wealth score, child and mother supplement group allocation.

In regard to ASF, 73% of the women had provided egg, flesh food or dairy product in the previous day at 12 mo, and the proportion increased to 88% at 18 mo, and 91% at 24 mo. At 12, 18, 24 mo, 16%, 32%, 35% of the children were receiving cow's milk, respectively. The lowest DD score was at 6 mo, when women were beginning to introduce foods and 18% of women reported still fully BF at 6 mo. The scores improve at 9 mo, which may reflect a greater proportion of infants receiving foods at this time, but may be artificially high because it does not represent intake on the previous day. The DD scores are low at 12 mo but gradually improve thereafter.

At 6 and 9 mo, 44% and 85% of the women were feeding soups or broths, respectively.

Dietary diversity scores improved during 6 to 24 mo (Table 2.4), but the mean dietary diversity scores from 6-18 mo were below 4, which is the minimum acceptable score recommended by the WHO. At 24 mo, children were barely meeting the minimum acceptable dietary diversity

Maternal fatness was not associated with DD score at any time point (Table 2.5). The interaction between maternal BMI and child age was not significant for DD score (Table 2.6). Wealth (p=0.01) and education (p=0.032) significantly modified the effect of child age. At 24 mo, the DD scores were ~0.5 points higher for children in wealthy households; whereas, for children whose mothers had less ≤ 6 y of education, the DD scores were 0.7 points lower. We obtained similar interactions when body fat was in the model (Appendix Table 2.5A).

Table 2.4 Unadjusted mean and median dietary diversity scores for each follow-up

Follow-up visit	Mean ± SD	Median (range)	N
6 mo	1.3 ± 1.3	1.0 (0, 6)	312
9 mo	3.1 ± 2.0	3.0 (0, 7)	328
12 mo	2.5 ± 0.85	2.5 (0.5, 5)	227
18 mo	3.3 ± 0.95	3.0 (1, 5.5)	177
24 mo	3.8 ± 1.04	4.0 (1, 6)	141

Table 2.5 Association between prepregnancy BMI and dietary diversity score at 6-24 mo of age. [a]

	6 mo (n=304)		9 mo (n=321)		12 mo (n=224)		18 mo (n=179)		24 mo (n=141)	
	β-coefficient and Standard Error									
		p		p		p		p		p
Unadjusted										
BMI	0.031 ± 0.017	0.070	0.023 ± 0.025	0.36	0.016 ± 0.013	0.24	0.022 ± 0.017	0.19	0.030 ± 0.020	0.14
Adjusted										
BMI, *kg/m²*	0.023 ± 0.018	0.24	0.040 ± 0.027	0.15	0.012 ± 0.015	0.41	0.027 ± 0.018	0.14	0.024 ± 0.022	0.25
Maternal Age, *y*	0.007± 0.16	0.13	-0.055 ± 0.025	0.21	-0.031 ± 0.014	0.82	-0.017 ± 0.016	0.31	0.011 ± 0.021	0.56
Education, *≤6 y*	0.23 ± 0.14	0.13	-0.27 ± 0.21	0.21	-0.069 ± 0.12	0.56	-0.32 ± 0.15	0.035	-0.09 ± 0.18	0.59
Wealth, *score*	0.086 ± 0.087	0.33	0.075 ± 0.12	0.55	-0.056 ± 0.074	0.45	0.23 ± 0.091	0.011	0.33 ± 0.11	0.003
Multiparity	0.10 ± 0.19	0.59	0.65 ± 0.26	0.013	0.041 ± 0.15	0.78	0.030 ± 0.18	0.87	0.053 ± 0.23	0.80
Indigenous ethnicity	0.11 ± 0.17	0.52	0.21 ± 0.24	0.38	0.071 ± 0.13	0.59	0.057 ± 0.16	0.72	-0.14 ± 0.20	0.45
Child supplement, *MMN*	0.032 ± 0.15	0.82	-0.34 ± 0.21	0.089	-0.15 ± 0.11	0.20	-0.028± 0.14	0.84	0.08 ± 0.17	0.63
Mom supplement, *MMN*	0.029 ± 0.14	0.84	-0.22 ± 0.21	0.26	0.11 ± 0.11	0.36	0.12 ± 0.14	0.39	0.15 ± 0.18	0.38
R^2	0.03		0.05		0.03		0.07		0.10	

[a] 7 food groups: grains/tubers, fruits, vegetables, legumes, egg, flesh foods, and dairy (i.e., cheese, cow's milk, infant formula, yogurt). Score range: 0 to 7

Table 2.6 Association between prepregnancy BMI and dietary diversity score from 6-24 mo of age. Random intercept model.

	Model 1 [a]		Model 2 [a]		Model 3 [a]	
	β-coefficient ± SE	p	β-coefficient ± SE	p	β-coefficient ± SE	p
Child age[1], *d*	0.0038 ± 0.00021	<0.001	0.0038 ± 0.00021	<0.001	0.0042± 0.0031	<0.001
BMI [2], *kg/m²*	0.022 ± 0.013	0.089	0.022 ± 0.013	0.089	0.023 ± 0.013	0.082
Maternal age, *y*	-0.011 ± 0.012	0.38	-0.01 ± 0.012	0.38	-0.00093 ± 0.00043	0.34
Education, *≤6 y*	-0.074 ± 0.11	0.49	-0.071 ± 0.12	0.51	0.23± 0.18	0.20
Wealth [3], *score*	0.12 ± 0.063	0.061	-0.088 ± 0.072	0.39	0.11 ± 0.062	0.062
Multiparity	0.24 ± 0.13	0.071	0.23 ± 0.13	0.078	0.24 ± 0.13	0.070
Indigenous ethnicity	0.067 ± 0.12	0.57	0.071 ± 0.12	0.56	0.067 ± 0.11	0.57
Child supplement, *MMN*	-0.095 ± 0.10	0.36	-0.089 ± 0.10	0.39	-0.10 ± 0.10	0.33
Mom supplement, *MMN*	-0.0098 ± 0.10	0.92	-0.01 ± 0.10	0.90	-0.01 ± 0.10	0.91
Interaction term [a]	-	-	0.00065 ± 0.00022	0.011	-0.00093 ±0.00044	0.032
Variance components						
Constant	0.38 ± 0.076		0.38 ± 0.076		0.38 ± 0.076	
Residual	1.64 ± 0.082		1.63 ± 0.081		1.63 ± 0.081	

[a] Model 1: main effects; Model 2: interaction between wealth and child age; Model 3 interaction between education and child age.
[1]Child age centered at 6 mo. [2] BMI centered at mean (24.5). [3] Wealth centered at mean (-0.035; sd= 0.87)

Child Feeding Index. On average, CFI scores decreased throughout the follow-up period (Table 2.7). Women exhibited very good feeding behaviors at 1 and 3 mo. At 6 mo, CFI scores were the lowest, improved somewhat at 9 mo, but declined thereafter.

High CFI scores at 1 and 3 mo were largely attributable to full and exclusive BF (79% at 1 mo and 76% 3 mo). At 6 mo, the use of bottles negatively impacted the score (see Table 2.2A). The increase in CFI score at 9 mo reflects the contribution of the high mean DD score. From 12-24 mo, use of carbonated beverages negatively affected CFI scores despite improvements in DD scores.

BMI was not significantly associated with CFI at any time between 1-24 mo (Table 2.8). We obtained similar results with body fat (Appendix Table 2.5A). BMI modified the effect of child age on CFI score (p=0.071) such that as the child grew older, an increase in one BMI unit slowed the rate of decrease in CFI score (Table 2.9). By 24 mo, the interaction between BMI and child age could be interpreted as a + 0.08 unit in CFI score. The interaction between wealth and child age was also significant (p=0.080). Only body fat interacted with child age (see appendix Table 2.6A)

Table 2.7 Unadjusted mean and median CFI scaled score throughout the follow-up.

Follow-up visit	Mean ± SD	Median (range)	N
1 mo	8.0 ± 2.2	9.3 (2.0, 10.0)	353
3 mo	7.6 ± 2.3	9.3 (1.3, 10.0)	351
6 mo	6.0 ± 1.8	5.0 (2.5, 10.0)	307
9 mo	6.8 ± 1.9	7.4 (0.5, 10.0)	324
12 mo	6.6 ± 1.1	6.7 (2.3, 8.2)	227
18 mo	6.1 ± 1.6	6.4 (2.1, 9.1)	177
24 mo	5.5 ± 1.8	5.3 (1.7, 9.4)	141

Table 2.8 Association between prepregnancy BMI and Child Feeding Index scaled score at 1-24 mo of age.[a]

	1 mo (n=350)	3 mo (n=343)	6 mo (n=299)	9 mo (n=317)	12 mo (n=224)	18 mo (n=170)	24 mo (n=140)
	β-coefficient and Standard Error						
Unadjusted							
BMI	-0.036 ± 0.030 p=0.20	0.0001± 0.030 p=0.99	0.019 ± 0.024 p=0.43	-0.014 ± 0.026 p=0.59	-0.006 ± 0.017 p=0.70	0.030 ± 0.029 p=0.30	0.046 ± 0.03 p=0.19
Adjusted[1]							
BMI, *kg/m²*	-0.012 ± 0.31 p=0.70	0.008 ± 0.03 p=0.80	0.029 ± 0.027 p=0.28	-0.0069 ± 0.029 p=0.8	-0.006 ± 0.019 p=0.71	0.014 ± 0.032 p=0.67	0.038 ± 0.038 p=0.32
Maternal Age, *y*	-0.11 ± 0.03 p<0.00	0.001 ± 0.031 p= 0.97	0.013 ± 0.027 p=0.62	-0.054 ± 0.026 p=0.04	0.029 ± 0.018 p=0.10	0.037 ± 0.029 p=0.21	0.050 ± 0.035 p=0.16
Education, *≤6 y*	-0.13 ± 0.25 p=0.60	0.17 ± 0.27 p=0.51	0.33 ± 0.22 p=0.14	-0.14 ± 0.22 p=0.52	-0.19 ± 0.15 p=0.58	-0.066 ± 0.26 p=0.80	0.10 ± 0.32 p=0.74
Wealth, *score*	-0.076 ± 0.14 p=0.60	0.076 ± 0.15 p= 0.62	-0.094 ± 0.13 p=0.45	-0.076 ± 0.13 p=0.57	0.05 ± 0.092 p=0.59	0.21 ± 0.16 p=0.19	0.38 ± 0.19 p=0.052
Multiparity	0.94 ± 0.30 p=0.02	-0.047 ± 0.32 p=0.90	-0.27 ± 0.27 p=0.31	0.36 ± 0.27 p=0.18	-0.15 ± 0.16 p=0.63	-0.19 ± 0.31 p=0.55	-0.46 ± 0.39 p=0.24
Indigenous ethnicity	0.14 ± 0.13 p=0.61	-0.23 ± 0.29 p=0.42	-0.093 ± 0.24 p=0.71	0.40 ± 0.25 p=0.10	0.078 ± 0.16 p=0.63	0.32 ± 0.29 p=0.26	0.48 ± 0.35 p=0.17
Child Supplement, *MMN*	-0.40 ± 0.24 p=0.85	-0.22 ± 0.25 p=0.38	-0.50 ± 0.21 p=0.020	-0.35± 0.21 p=0.10	-0.097 ± 0.14 p=0.50	-0.10 ± 0.25 p=0.69	-0.30 ± 0.31 p=0.33
Mom Supplement, *MMN*	-0.23 ± 0.24 p=0.32	-0.22 ± 0.25 p=0.38	-0.163 ± 0.21 P=0.44	-0.38 ± 0.21 p=0.07	-0.013 ± 0.56 p=0.36	-0.47 ± 0.25 p=0.058	-0.38 ± 0.31 p=0.25
R^2	0.05	0.01	0.03	0.04	0.05	0.07	0.11

[a] Index includes breastfeeding (exclusive, full and any), bottles and syringes, sweetened and carbonated beverages, and dietary diversity. Score range: 0 to 10.

Table 2.9 Association between prepregnancy BMI and Child Feeding Index scaled score from 1-24 mo of age. Random coefficient models

	Model 1 [a]		Model 2 [a]		Model 3 [a]	
	β-coefficient ± SE	p	β-coefficient ± SE	p	β-coefficient ± SE	p
Child age[1], *d*	-0.0033 ± 0.00028	<0.001	-0.0032 ± 0.00025	<0.001	-0.0032 ± 0.00025	<0.001
BMI[2], *kg/m²*	0.011 ± 0.015	0.45	-0.022	0.35	0.011 ± 0.015	0.46
Maternal age, *y*	0.00085 ± 0.014	0.95	-0.0003 ± 0.014	0.92	0.001 ± 0.014	0.93
Education, *≤6 y*	-0.011 ± 0.12	0.93	-0.012 ± 0.12	0.92	-0.0074 ± 0.12	0.95
Wealth[3], *score*	0.042 ± 0.072	0.55	0.042 ± 0.072	0.56	-0.11 ± 0.11	0.34
Multiparity	-0.015 ± 0.15	0.92	-0.017 ± 0.15	0.94	-0.20 ± 0.13	0.15
Indigenous ethnicity	0.19 ± 0.14	0.16	0.20 ± 0.13	0.14	0.19 ± 0.13	0.15
Child supplement, *MMN*	-0.24 ± 0.11	0.049	-0.23 ± 0.12	0.044	-0.23 ± 0.12	0.055
Mom supplement, *MMN*	-0.29 ± 0.11	0.013	-0.29 ± 0.12	0.013	-0.29 ± 0.12	0.013
Interaction term [a]	-	-	0.0001± 0.000061	0.071	0.0005 ± 0.00029	0.080
Variance components						
Child age	$8.31 \times 10^{-6} \pm 1.69 \times 10^{-6}$		$8.31 \times 10^{-6} \pm 1.69 \times 10^{-6}$		$8.19 \times 10^{-6} \pm 1.68 \times 10^{-6}$	
Constant	2.37 ± 0.29		2.37 ± 0.29		2.36 ± 0.29	
Covariance	-0.004 ± 0.0006		-0.004 ± 0.0006		-0.004 ± 0.0006	
Residual	2.77 ± 0.11		2.77 ± 0.11		2.77 ± 0.11	

[a] Model 1: main effects; Model 2: interaction between BMI and child age. Model 3: interaction between wealth and child age
[1] Child age centered at 1 mo. [2] BMI centered at mean (24.5). [3] Wealth centered at mean (-0.035 ±0.87)

2.4 Discussion

To our knowledge, this is the first study in which the association between pre-pregnancy maternal fatness and dietary diversity as well as child feeding practices in the first two years of life have been assessed. Moreover, we are the first to examine this association in a developing-country context where maternal fatness is a public health concern. We did not find a significant association between pre-pregnancy fatness and BF duration or with dietary diversity. We did, however, find a significant statistical interaction between maternal fatness and child feeding practices as assessed by our CFI score, but the interaction was of little public health significance. Our data shows that heavier women are not engaging in feeding behaviors that are distinct from normal-weight women from 1-24 mo.

Our detailed analysis of the complementary diet and child feeding practices are strengths of this research. For the complementary diet, we slightly modified the WHO DD indicator, which captures micronutrient density (29). Inasmuch as maternal weight is a consequence of diet, maternal fatness may be a proxy for the household food environment. Therefore, it was possible that children born to heavier women would be exposed to a greater variety of food. In Denmark, obese women introduced foods 3 wk earlier (15 vs. 12 wk) than the normal-weight women (6), although researchers did not assess the complementary diet. We did not find an association with maternal weight and DD score at any time during follow-up. DD scores improved over time regardless of maternal BMI. We were unable to fit random slope models for the DD scores because there was little variability between children on the DD score.

Another strength of this paper is that we examined a collection of feeding behaviors by constructing an index. Researchers had examined the duration of breastfeeding and the timing of introduction of solid foods but as separate outcomes (3). Our index allowed us to link breastfeeding to complementary feeding practices at

each time point. Although we did not observe an association with BMI and dietary diversity or BF duration, BMI modified the effect of child age on CFI score. It is possible that, in the aggregate, our CFI index is capturing what our individual analyses were unable to detect. The interaction indicates that maternal BMI is associated with poorer child feeding behaviors in early infancy (e.g., feeding of formula, using bottles) and higher DD scores in the second year of life, which slows the decline of CFI scores over time. The magnitude of the interaction was small, which suggests that for this population the influence of maternal BMI on child feeding practices between 1-24 mo is likely to be negligible overall.

Our findings for DD and CFI were not due to insufficient statistical power. Post-hoc power calculations revealed that we had a sufficiently large sample to detect a 1-unit change on the CFI score (α=0.05, sd=2, n for sample=128). There was 90% power in our sample to detect a 1-unit change on the DD score.

The *Guiding Principles* outlines 9 best practices for child feeding (25). Given the data available, we could only measure 4 of these best practices: exclusive breastfeeding and age of introduction of food, continued breastfeeding, safe storage of foods (i.e., avoid bottles), and nutrient content of food, which we captured with the DD index and with sweetened beverages. Thus, our inferences about the association of maternal fatness with child feeding practices are limited to these behaviors and how they were measured in this study. For example, energy density may have been a more suitable measure of complementary feeding than dietary diversity given the homogenous feeding practices in our sample. We did not use energy density because we did not have this data at 6 and 9 mo. Other behaviors that were not measured include responsive feeding and amount of food, so we cannot draw inferences about these behaviors and maternal fatness from our data.

Our research was motivated by previous studies in the U.S. (2, 11, 16, 30),

Denmark (3, 6) and Australia (4), all which showed a positive association between maternal BMI and early cessation of BF. In their study of minority women in upstate New York, Kugyelka et al.(2) found that Hispanic women (mostly of Puerto Rican decent) who were obese before pregnancy were more likely to discontinue exclusive and any BF sooner compared to their normal-weight counterparts. In their analysis of U.S. pediatric surveillance data of low-income children, Li et al. (30) corroborated these findings that maternal pre-pregnancy obesity was associated with a shorter duration of any BF. Among Danish women, Baker and colleagues (6) showed that pre-pregnancy obesity was associated with a higher risk for cessation of full BF at 1 wk post-partum, and a greater proportion of these women used infant formula in the first 6 mo (64% in the normal-weight vs. 72% in the obese class I).

There are 4 important possible reasons for why our findings differ from those in the literature. First, BF practice in our sample was relatively homogenous; termination of full BF was mostly attributable to the introduction of solid foods, formula use was uncommon, and women breastfed well into the second year of life. Second, we had a relatively small proportion of obese women (9%) and most were obese class I (82%, BMI 30-35 kg/m^2). An insufficient proportion of women in the obese category terminated BF and post-hoc power calculations revealed that we were underpowered to detect a 20% higher hazard ratio among the overweight/obese women, if that difference were to exist. Our sample had a lower mean BMI (24.4 ± 4.1 kg/m^2) than the concurrent nationally representative sample of Mexican women. In 1999, data from the National Nutrition Survey showed that mean BMI in Mexican women 12-49 years was 26.5 ± 4.8 kg/m^2 and 38% were overweight and 19% of the women were obese (31). The differences in BMI may be related to lighter, younger women becoming pregnant, women who would also be more likely to participate in this supplementation trial. Our outcomes reflect the performance of overweight

women rather than obese women per se. In the Danish data, the risk for cessation of full and any BF among overweight women was low, 7% and 12%, respectively (6).

Third, the majority of the obese women in our study were mulitparous. Parity can influence breastfeeding outcomes via two mechanisms: through previous experience with breastfeeding, and through higher milk volumes by 1 wk post partum (32). These two mechanisms also contributed to a lack of difference in breastfeeding duration between normal-weight and obese women.

Fourth, women included in our study were sampled from a community that was mostly low-income, where maternal employment was low, and the male head of the household was employed in agricultural labor. The economic constraints of the households may be a powerful motivator to continue breastfeeding, despite the physiological or mechanical difficulties, given that the alternatives (formula or solid foods) are more expensive. In the U.S. and Denmark where infant formula are affordable, obese women can choose the alternative and discontinue breastfeeding sooner at will. Taken together, the homogenous breastfeeding behavior, alternatives being unaffordable, and a small proportion of obese women, who were mostly multiparous, may explain why we obtained different results from the published literature. It is possible, however, that as Mexican women become fatter at a younger age (i.e., heavier nulliparous women) we may observe more women choosing other feeding options.

There are a few limitations in our study. We controlled for the salient sociodemographic factors that are causes of the outcomes and the independent variables, but we cannot rule out residual confounding particularly from income as it was not included in our wealth score. From our work in this community, we know that money is a key factor for the purchase of flesh foods and non-human milk. Although we can establish temporality between exposure and the outcome, this was an

observational study and thus we cannot ascertain cause and effect relationships. Lastly, women remaining in the study may have had better behaviors than those that dropped out, and so we cannot rule out drop-out bias.

Given that in this sample termination of full BF was related to feeding solid foods, the possibility exists that maternal fatness may be associated with duration of full BF. Data at 4 or 5 mo was not collected, which is when some women may have begun feeding solid foods.

In women, BMI correlates moderately with body fatness (r = 0.81) (33), and there is some concern that BMI may not adequately measure fatness especially among women of short stature (<150 cm) (34). This is because the squared term in the denominator may not adequately adjust for height in short women. Because our mean height was 148 cm, we decided to include another measure of body fat. Given that Hispanic women carry a larger percentage of their weight in the trunk (35), body fat as estimated here might be a sensitive measure of adiposity because we considered abdominal circumference. Using percent body fat as the predictor gave similar results as BMI, and therefore we believe that BMI reflects maternal adiposity. In our sample, BMI was highly correlated with waist circumference (r=0.91) and subscapular and tricep skinfolds (r=0.81), but was not correlated with height (r= -0.04).

We conducted a sensitivity analysis in which we changed the relative scoring of the food groups (i.e., assigning a 2 to the ASF) or changed the scoring of the groups across time—for example scoring fruits and vegetables a 2 at 6 mo as these are likely to be first foods—but neither approach changed our main results. We also removed cow's milk and formula from the DD and scored them in our CFI index, but this too did not change our results regarding maternal fatness (data not shown). We also assessed whether our DD scores and CFI scores were related to weight at 24 mo, given that DD and CFI indices have been associated with growth outcomes (36, 37). We did

not observe an association between weight at 24 mo and cumulative DD scores (β=0.024 kg, p=0.45, unadjusted, n=104) (summed our DD scores from 6-18 mo for children with complete visits), which may indicate that the children are meeting their energy and nutrient needs with breast milk. The association between cumulative CFI scores and weight did not reach statistical significance in both adjusted and unadjusted models (β= -0.035 kg, p= 0.068, adjusted for wealth, n=93).

2.5 Conclusion

In our sample, maternal pre-pregnant fatness was not associated with the duration of full and any BF. In this low-income population, heavier women with previous breastfeeding experience were able to continue breastfeeding. Also, maternal pre-pregnant fatness was not associated with dietary diversity from 6-24 mo or with child feeding practices as captured by our index in the first two years of life. There was a small interaction of BMI and child age, but it was of little public health relevance. Nonetheless, given the increases in the prevalence of obesity in Mexico in the last 10 y, this study should be replicated in a larger, contemporary sample of Mexican women where different socioeconomic groups would be represented. This would ensure sufficient variation in child feeding strategies per category of BMI.

The relative homogeneity in child feeding practices (i.e., breastfeeding extended well into the second year of life, poor dietary diversity from 6-18 mo, and use of sweetened/carbonated beverages) suggests other unmeasured socio-cultural factors are shaping child feeding practices in this community. Because child feeding is a cultural practice, other methods suited to study social behavior can provide valuable insights to the relationships observed in epidemiologic studies. The following two chapters examine complementary feeding practices in Xoxocotla, Morelos using ethnographic methods and theories.

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APPENDIX 2

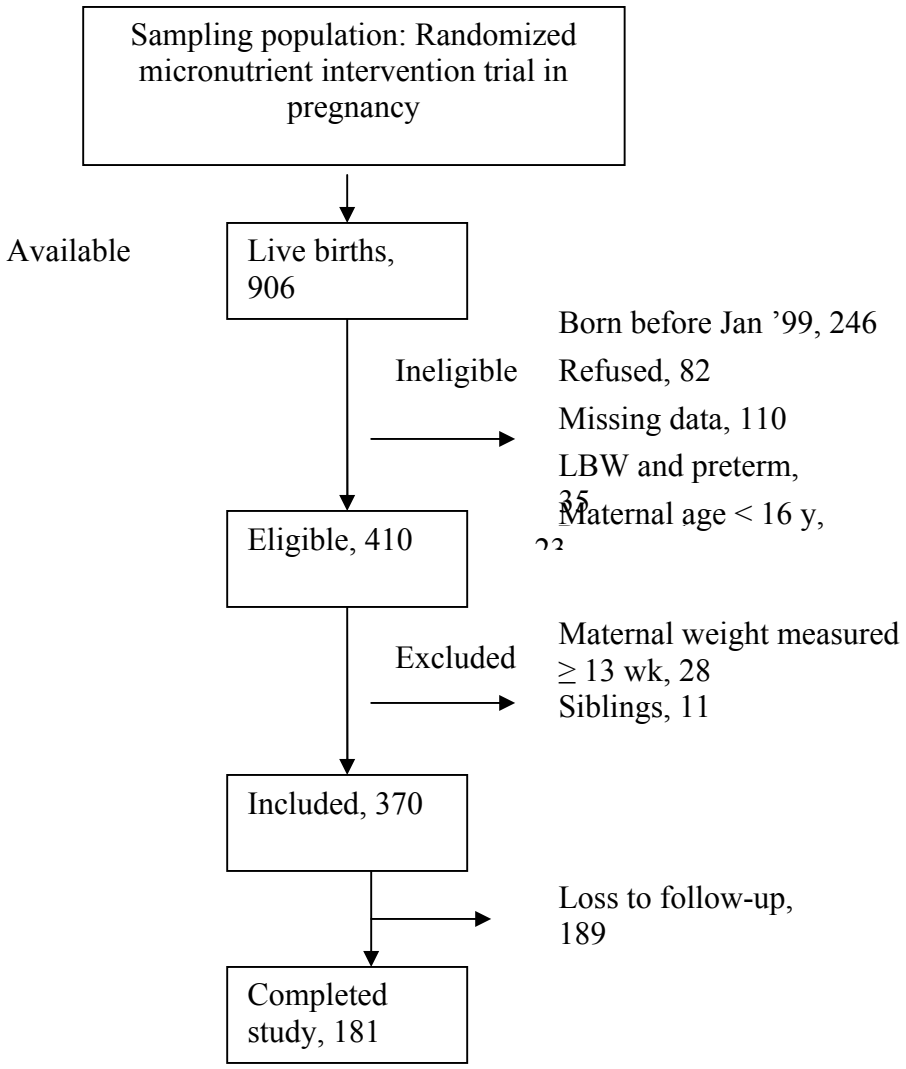

Figure 1. Description of selection of mother-child pairs included in the analysis

Table 2.1A. Characteristics of women included and excluded from the analysis.

Characteristic	Included (n=370)	Excluded (n=38)	p-value
Parity, *n*	1 (0,11)	1 (0,5)	0.79
Maternal age, *y*	23.7 ± 5.1	23.8 ± 5.1	0.68
Wealth	-0.036 ± 0.9	-0.18 ± 0.8	0.28
Education	6 (0, 15)	7 (0, 16)	0.70
Weeks pregnant, *wk*	8.6 ± 1.96	12.5 ± 3.1	<0.001
People in home, *n*	5 (1, 23)	5 (2, 14)	0.75
Indigenous ethnicity	30%	27%	0.69
Married	70%	72%	0.58
Vaginal delivery	61%	74%	0.098
Weight, *kg*	54.0 ± 9.8	53.9 ± 10.2	0.95
Height, *cm*	148.5 ± 4.9	149 ± 4.2	0.12
Waist circumference, *cm*	78.9 ± 8.9	77.7 ± 9.2	0.51
BMI, kg/m^2	24.4 ± 0.21	24.0 ± 0.68	0.56
Underweight (<18.5 kg/m^2), *n*	14 (4%)	4 (10%)	0.07
Normal-weight (18.5-24.9 kg/m^2), *n*	207 (56%)	23 (57%)	
Overweight (25.0-29.9 kg/m^2), *n*	116 (31%)	7 (8%)	
Obese (≥30 kg/m^2), *n*	32 (9%)	6 (15%)	
Percent body fat	29.2 ± 5.8	28.3 ± 5.6	0.41
Child			
Birth weight, *kg*	3.1 ± 0.3	3.1 ± 0.3	0.90
Gestational age, *wk*	39.8 ± 0.7	39.7 ± 0.8	0.40
Sex, *girls*	43%	40%	0.49

Table 2.2A. Behaviors in the Child Feeding Index for each follow-up period.

Behavior	Follow-up (months)						
	1 (n=354)	3 (n=352)	6 (n=312)	9 (n=328)	12 (n= 229)	18 (n=177)	24 (n= 141)
EBF	114 (32) [1]	50 (14)	2 (0.5)	-	-	-	-
FB	167(47)	221 (63)	56 (18)	2 (0.5)	-	-	-
Any BF	63 (17)	69 (19)	232 (75)	276 (84)	209 (91)	132(74)	72 (52)
Formula[2]	58 (16)	57 (16)	49 (15)	52(16)	18 (7)	4 (2)	3 (2)
Cow's milk[2]	2 (0.5)	2 (0.5)	7 (2)	22(6)	35 (15)	57 (32)	49 (35)
Bottles and syringes	119 (34)	135 (37)	169 (54)	99 (30)	-	-	-
Complementary food	0	24 (6)	-	-	-	-	-
Sweetened beverages	8 (2)	9 (2)	2 (0.5)	208 (63)	9(4)	17 (10)	16 (11)
Carbonated Beverages	-	-	-	-	67 (29)	88 (50)	79 (56)

[1]Percentages in parentheses [2] From 6-24 mo, cow's milk and formula were captured in the dietary diversity
index in the dairy category. Cow's milk and formula were not scored at 1 and 3 mo.

Table 2.3A Hazard ratios for termination of full and any breastfeeding with body fat as the predictor.

Variables	Full breastfeeding Hazard ratio (95% CI)	P-values	Any breastfeeding Hazard ratio (95% CI)	P-values
Month[1]				
3	0.58 (0.35, 0.95)	0.003	0.17 (0.021, 1.43)	
6	6.76 (4.71, 9.70)	<0.001	0.40 (0.081, 1.99)	
9	13.3 (8.04, 22.11)	<0.001	1.10 (0.35, 3.41)	
12	-		1.74 (0.56, 5.42)	
18	-		10.06 (4.14, 24.44)	
24	-		17.13 (7.22 40.63)	
Body fat, *%*	1.01 (0.99, 1.04)	0.25	1.00 (0.96, 1.04)	0.66
Maternal age, *y*	1.01 (0.98, 1.05)	0.32	0.98 (0.93, 1.03)	0.46
Parity, *n*	0.81 (0.54, 1.12)	0.23	1.41 (0.80, 2.50)	0.23
Education[1]	0.76 (0.55, 1.06)	0.11	0.90 (0.57, 1.40)	0.63
Indigenous ethnicity	0.91 (0.65, 1.23)	0.62	0.77 (0.46, 1.30)	0.32
Wealth score	0.99 (0.82, 1.20)	0.94	0.93 (0.71, 1.22)	0.63
Child supplement, *MMN*	0.95 (0.70, 1.29)	0.77	1.17 (0.75, 1.81)	0.48
Mother supplement, *MMN*	1.13 (0.84, 1.53)	0.39	1.31 (0.84, 2.10)	0.23

Table 2.4A. Food categories provided to the children for each follow-up period.

Food category	Follow-up (months)				
	6 (n=312)	9 (n=328)	12 (n= 229)	18 (n=177)	24 (n= 141)
Grains [a]	63 (20)[1]	223 (68)	191 (83)	171 (96)	139 (98)
Fruit	188 (60)	268 (70)	146 (64)	128 (72)	97 (69)
Vegetable	37 (12)	99 (30)	8 (3)	10 (6)	12 (9)
Legume [b]	5 (2)	22 (7)	6 (3)	40 (23)	63 (45)
Egg	24 (8)	128 (39)	48 (21)	61 (34)	70 (50)
Flesh foods [c]	25 (8)	147 (45)	47 (21)	81 (46)	86 (61)
Dairy [d]	13 (4)	76 (23)	70 (33)	63 (36)	51 (37)

[1]Percent in parentheses. [a] From 1-9 mo, rice and tortilla only. [b] From 1-9 mo, beans only.
[c] From 1-9 mo, fish consumption was not asked. [d] From 1-9 mo, yogurt consumption was not asked.

Table 2.5A. Coefficients and standard errors from the random intercept models for dietary diversity score.

	Model 1		Model 2		Model 3	
	β-coefficient and Standard Error					
		p		P		P
Child age[1], *d*	0.0033 ± 0.00026	<0.001	0.0034 ± 0.00026	<0.001	0.0038± 0.0035	<0.001
Body fat[2], *%*	0.018 ± 0.011	0.087	0.019 ± 0.011	0.10	0.019 ± 0.012	0.10
Maternal age, *y*	-0.0011 ± 0.014	0.59	-0.011 ± 0.015	0.47	-0.011 ± 0.015	0.45
Education, *≤6 y*	-0.12 ± 0.13	0.23	-0.12 ± 0.13	0.35	0.052 ± 0.17	0.76
Wealth[3], *score*	0.057 ± 0.078	0.134	-0.076 ± 0.095	0.42	0.058 ± 0.079	0.46
Multiparity	0.23 ± 0.16	0.27	0.23 ± 0.15	0.15	0.23 ± 0.16	0.15
Indigenous ethnicity	-0.052 ± 0.14	0.52	-0.050 ± 0.14	0.73	-0.047 ± 0.14	0.75
Child supplement, *MMN*	-0.11 ± 0.12	0.40	-0.10 ± 0.12	0.42	-0.11 ± 0.12	0.40
Mom supplement, *MMN*	0.087 ± 0.12	0.49	-0.085 ± 0.12	0.42	-0.084 ± 0.13	0.51
Interaction term [a]	-	-	0.00071 ±0.00029	0.013	-0.00089 ± 0.0004	0.062
Variance components						
Constant	0.38 ± 0.094		0.37 ± 0.093		0.38 ± 0.094	
Residual	1.75 ± 0.10		1.75 ± 0.12		1.74 ± 0.10	

[a] Model 1: main effects; Model 2: interaction between wealth and child age; Model 3 interaction between education and child age.
[1] Child age centered at 6 mo. [2] Body fat centered at mean (29.2). [3] Wealth centered at mean (-0.35)

Table 2.6A. Coefficients and standard errors of the random coefficient models for the CFI scaled score.

	Model 1		Model 2	
		p		P
Child age[1], *d*	-0.0033 ± 0.00023	<0.001	-0.0033 ± 0.00028	<0.001
Body fat[2], *%*	0.004 ± 0.014	0.75	-0.023 ± 0.021	0.26
Maternal age, *y*	-0.0076 ± 0.019	0.66	0.009 ± 0.017	0.61
Education, *≤6 y*	0.0012 ± 0.16	0.99	-0.00038 ± 0.15	0.99
Wealth[3], *score*	0.084 ± 0.094	0.35	0.083 ± 0.090	0.36
Multiparity	0.04 ± 0.19	0.80	0.051 ± 0.18	0.78
Indigenous ethnicity	0.31 ± 0.17	0.064	0.32 ± 0.17	0.14
Child supplement, *MMN*	-0.23 ± 0.15	0.11	-0.24 ± 0.14	0.097
Mom supplement, *MMN*	-0.34 ± 0.15	0.017	-0.34 ± 0.14	0.015
Interaction term [a]	-	-	0.000085	0.078
Variance components				
Child age	$7.09 \times 10^{-6} \pm 1.76 \times 10^{-6}$		$7.12 \times 10^{-6} \pm 1.76 \times 10^{-6}$	
Constant	2.25 ± 0.35		2.24 ± 0.35	
Covariance	-0.0036 ± 0.00072		-0.0036 ± 0.00072	
Residual	2.87 ± 0.14		2.87 ± 0.14	

[a] Model 1: main effects; Model 2: interaction between percent body fat and child age.
[1] Child age centered at 1 mo. [2] Body fat centered at mean (29.2). [3] Wealth centered at mean (-0.35)

Chapter 3

The cultural recipe: Mexican mothers' conceptualizations and complementary feeding practices

Abstract

Although qualitative formative research in nutrition is intended to reveal cultural features that affect program delivery, relatively little attention has been paid to describing and interpreting the underlying conceptual structure of complementary feeding practices. The aim in this study was to examine the conceptualizations of feeding practices among low-income women with young children in Morelos, Mexico. I used ethnographic techniques and anthropological theories to design a study to elucidate maternal knowledge and child feeding practices. I conducted in-depth interviews and home observations among 29 women with young children 6-18 months. Transcripts were systematically reviewed to identify major themes related to feeding young children, and data were coded using a combination of preselected codes as well as codes that emerged from the identification of themes. Observations augmented the information that was obtained through verbal exchange. I identified 8 concepts: (1) *probaditas* (the idea of introducing small tastes of foods), (2) preparing separate foods for infants, (3) readiness to eat solid foods, (4) appropriate consistency, (5) the value of variety, (6) child likes and dislikes, (7) money and food costs, and (8) healthiness of foods (positive and negative foods). There was strong evidence of cultural consensus (sharing of knowledge among the respondents), and the underlying motivation was to provide foods to ensure good growth and health. This knowledge structure guided practices, and household finances and food preferences of family members influenced what to feed and how often. I found a clear demarcation of "core foods" (soups, broths, tortilla), "secondary core foods" (fruits, vegetables, animal-

source foods), and “peripheral foods” (Danonino, yogurt, Yakult, *atole*). In summary, there is a cultural prescription for how to feed children, which has implications for how to improve upon existing child feeding practices in this community.

3.1. Introduction

Good complementary feeding practices ensure that infants and young children consume appropriate quantity and quality of foods that reduce the likelihood of stunting and micronutrient deficiencies (1) as well as ameliorate the impact of infectious diseases on child mortality (2). Good practices include feeding a variety of semi-solid or solid foods, particularly animal-source foods, 2-4 times/d, depending on age, from 6-24 mo (3). Yet many children in developing countries are not fed according to these practices. In Mexico, for example, 25% of the infants in low-income households do not regularly consume cereals and legumes, and animal food products, including non-human milk, by 9 mo (4). Thus the diets of infant and young children in developing countries lack micronutrients that are essential for optimal growth and development (1, 5), and improving the diets is a world-wide, public health priority (1).

To this end, qualitative work has been undertaken to elucidate the socioeconomic determinants and, more recently, the psychosocial dimensions of complementary feeding (e.g., beliefs, attitudes, values, key actors, and key barriers) (6-10). Although qualitative approaches have undoubtedly improved researchers' understanding of complementary feeding practices in different cultures and contexts, this understanding still remains fragmentary because researchers have not yet captured the complexity of women's knowledge via appropriate qualitative methods.

Feeding practices are a cultural practice in that maternal knowledge about child feeding generates maternal behavior. The knowledge framework for child feeding is embedded in the social realities of everyday life. The presence of other caregivers, food access, financial constraints, and household organization are interconnected with the culture of child feeding. The interplay among these factors is what determines the child's diet. Although many researchers use qualitative methods to uncover these

factors, child feeding is not viewed from this lens. Instead, complementary feeding is approached from the practitioner's perspective—of changing maternal behavior—and does not allow a full appreciation of maternal knowledge.

The aim of this study was to make explicit how women feed their children to provide a broader and less fragmented understanding of complementary feeding. A complete and informed understanding provides a platform from which one can engage women to improve upon existing practices. I used ethnography to elicit the meaning behind social practices from the actor's perspective (11) and to reveal the conceptual structure underlying maternal behavior. The concepts, meaning, and the context in which participants are embedded were taken together to derive an explanation about child feeding practices (12), and thus opening the possibility to a different way of thinking about complementary feeding. The biocultural framework, used in nutritional anthropology, embeds knowledge of child feeding within a food-producing system and at the center of the model is the child's diet (13). I used this framework to guide our research.

3.2. Methodology

3.2.1. Study setting

The community studied, Xoxocotla, is a small town located 40 km south of Cuernavaca in the state of Morelos. The community is easily accessed by a large toll highway connecting Mexico City to Acapulco. Today, there are 21, 000 inhabitants, of which 5606 are women of childbearing age (15-49 y) (14). The main occupation of the male head of household is agricultural or construction laborer (15), although recently, younger men are also working as motorcycle-taxi drivers. There are 2500 families that are *Oportunidades* beneficiaries (personal communication, Jorge, Health Promoter, July 2008)—the conditional cash transfer program where women receive monies if they meet a series of social obligations such as keeping their children in school and

seeking preventative health care. In 1997, the community was chosen as the site for a large micronutrient intervention study in pregnancy. About 1000 women were enrolled and the researchers have followed these women since. Among study participants, there has been a doubling of overweight and tripling of obesity in the last decade (15).

This community was chosen primarily because my collaborators, Mexican National Institute of Public Health (INSP acronym in Spanish), had been there more than 20 y and maintained a public health center from where I could work. Another consideration was that I had access to the data from the large micronutrient intervention trial in pregnant women and then subsequently their offspring that was conducted in this community from 1997-2003.

3.2.2. Researcher profile

I conducted all the field work. I lived in Cuernavaca from February to June 2009 and commuted each day to the field site. I had been in the community previously to this field experience and the physician and nurses at the public health center knew who I was. I am Latin American, so I speak fluent Spanish but I am not Mexican. I was an outsider in the community and my outsider status was evident in my physical appearance and my accent, which was not like theirs. My age, marital status, and status as a foreigner and professional created a complicated yet rich dynamic between them and me. My foreigner status had a certain appeal to women as they were eager to find out what I was doing there, but they also had reservations about why I was so far away from home. To counterbalance any reservations, I worked closely with a public health nurse who had been working in the community for at least 20 y who women in the community identified as Lolita.

3.2.3 Sampling strategy

I included non-pregnant women ≥18 y that had a healthy child between the ages of 6-18 mo. Because I was interested in mother-child interaction at meal times for

part of this dissertation, I chose 6-18 mo-old young children as mothers were more likely to actively feed the child. Lolita, the nurse and my research assistant, recruited the women. I relied on various strategies to obtain our participants: recruiting from waiting room at the clinic where the interviews were being conducted, referral from other women, the nurse's home visits, and her interaction with members of the community who fit our inclusion criteria. Also, midway through recruitment, and based on preliminary analysis of the interviews, I sampled more women with 12-18 mo-old children.

Recruitment happened twice a month. All women were recruited on a Monday, and then interviews were completed Tuesday to Friday. Home observations were scheduled during the following week. After completing 10 interviews and home observations, I took one week to review the interviews before recruiting the next set of 10 women. This strategy was repeated until I reached my target goal of 30 participants.

All women signed informed consent and authorized the home observation as well as tape-recording of the interview. Women were also promised confidentiality and so pseudonyms have been used here. In appreciation for their time, all women received a blanket for the baby at the end of the interview and a bib and t-shirt or plate and cup set at the end of the observation. Ethical approval for this study was obtained from the Ethics, Biosecurity, and Research Commission at INSP and the Institutional Review Board for Human Participants at Cornell University.

3.2.4 Methods

Interviews allow people to talk about what they know and what they do so that the researcher can build a systematic understanding of their knowledge (11). Observations expand our perception and allow us to obtain information that is difficult to capture from interviews (16). Most of the data for this paper are taken from the

interviews, and the home observations were used to develop more informed constructions of child feeding practices.

Interviews were conducted in a small room at the public health clinic, located one block from the main plaza. For each woman and her child, weight and height were measured by the public health nurse or me, and both of us had received training in anthropometry. Women were interviewed once and each interview lasted between 60-80 min. I transcribed the interview after each session.

Women knew that the home observation was part of the study when they were recruited; however, as most women live in extended families, I asked them to verify that the observation would be acceptable to their husbands and the matriarch. Of the 31 women recruited, 27 agreed to the home observation. Observations were scheduled at their convenience, usually from 8:30 am until 2 pm. In previous work in this community, INSP researchers had found that this observation schedule improved participation as it was less burdensome to the families. I did not stay for the main meal, often served between 2 and 4 pm, and I did not observe what happened in the evening when the father was likely to be home.

After I arrived at the house, the woman was instructed to go about her usual affairs. For most women, this meant observing them wash clothes by hand, wash stacks of dishes, prepare and eat the main morning meal (*almuerzo*), feed their children, and sometimes watch television. On a few occasions I accompanied the woman to pick up her children from school or go to the market. If the child was eating solid foods, I observed one feeding episode. Field notes were typed up as soon as possible after each observation.

Most families were welcoming and, although they were not obligated to provide food for the researcher, most women offered some meal, fruit or beverage. Women, and sometimes other female members of the house, were very open to talking

about the positive and negative aspects of being a mother and a wife. They were also intrigued by my status as a foreigner and wanted to know more about where I was from. I used these moments of open dialogue and rapport to clarify ideas or further explore other concepts mentioned in the interviews.

3.2.5 Field instruments

For the interview guide, one or two questions were used to elicit information on each dimension of the biocultural framework, with a focus on the diet of the child and the family. The wording of a few questions was modified slightly as women began using certain terms to describe particular behaviors or events. Also, questions about introducing new foods and the frequency of consumption of certain foods became more specific as the study progressed (the appendix has the final version of the interview guide).

The biocultural model has 5 domains: the *physical environment* considers the ecology and the built environment; the *social environment* subsumes how towns or cities can affect food availability; *social organization* encompasses the household structure and composition. *Technology* are the tools and techniques required for food preparation; and *culture and idea systems* encompass the role of food in health, food preferences and restrictions, and the use of food in social interactions (13).

For the *physical environment,* I was interested in the foods available at the local market, food venues, and *tiendas* (convenience stores). To discover if the *social environment* could affect food availability and purchasing, I inquired about trips to larger urban centers to acquire food. For the *social organization* I focused on the household because it is a proximal determinant of child feeding practices. I asked about foods available in the home and consumed, the mother's eating patterns (via a 24-h dietary recall), physical activity behaviors, caregivers involved in child feeding, particularly matriarchs or older female siblings, as well as maternal employment and

maternal activities in the home. Included here were questions regarding having enough money to purchase foods and use of government assistance programs. I asked about the use of processed foods to understand to what extent food *technology* was part of the complementary diet. I examined *culture* and *ideas* about breastfeeding, timing of introduction of solid foods, and child food consumption (including the amount of food served and consumed). I also asked about feeding advice received from family members or health care workers.

I developed a guide to structure the home observation around maternal, child, and family behaviors related to food and caring for children as well as for characterizing the physical home environment. I specifically looked for the presence of other caregivers (e.g., grandmothers, older female siblings, father), maternal activities (e.g., chores, remunerated work), food selection and eating habits of the mother, child (e.g., feeding episodes) and family (e.g., type and timing of meals, snacking), and certain caregiver behaviors (e.g., maternal interactions with the child). Women were aware that the researcher would only document these items (see appendix).

3.2.6. General analytical strategy.

Analysis does not necessarily constitute a separate phase in interpretive work. Throughout data collection, I read through the transcripts and considered what women were saying. Transcribing the interviews was also useful for understanding the subtleties of their words. During these instances, wording of questions were modified, probes were added or questions were developed to examine certain behaviors (e.g., food frequency of child and family foods). It was also during "breaks" from interviewing that the decision was made to sample more women with children over 1 y old as these women and children offered greater information on feeding children.

I read each transcript one after the other in careful detail to obtain the major

themes about feeding their children (first pass). The themes that emerged from this first pass were (a) child-appropriate foods and food frequency, (b) food preferences, (c) family foods, (d) and household finances, and (e) feeding advice and family members (fathers, grandmothers, mother-in-laws, siblings). Transcripts were then coded around these major themes in Atlas Ti (v 5.2, GmbH, Berlin) (second pass) using a combination of in-vivo codes and preselected codes. The Query Tool in Atlas Ti was used to look for patterns of shared cultural knowledge (pooled information across all interviews) to derive the key concepts for child feeding practices. Then I searched within each interview to examine what factors influenced child-appropriate foods. In doing so, clear links emerged among family foods, food preferences, financial resources, presence of other family members, and child feeding. A methodological memo that detailed the links was completed for each woman.

More detail about deriving the concepts are outlined in the results. When referring to other actors involved in child care, I refer to them by the familial relationship to the child. Thus when I speak about the father, I am also referring to the woman's husband, unless otherwise noted. Because the child had two grandmothers, I opted to reserve the term grandmother only for the maternal grandmother.

3.3. Results

I interviewed 31 women but eliminated 2 interviews because one child was premature, and these children have distinct feeding patterns compared to term infants, and the other interview was incoherent. The main social characteristics of women that participated in our study are presented in Table 3.1.

Table 3.1 Characteristics of the 29 women included in the analysis.

Characteristic	Summary statistic	Remarks
Maternal age, *y*	25.9 ± 5.3[1] (18, 37)	
Child age, *mo*	12.4 ± 4.1 (5, 18)	
Children ≥ 1 y	68%	
Body Mass Index, kg/m^2	28.4 ± 5.0 (17, 37)	
Women with BMI ≥ 30	41%	
Education, *y*	8 ± 2.2 (6, 12)	
Employment, *n*	7	Selling food: tortillas, vegetables or fruit
Government programs, *n*	8	4 received *Oportunidades* 4 received *Liconsa*
Lived with others, *n*	19	In-laws or parents
Married, *n*	26	
Parity, *n*	2.2 ± 1.04 (1, 5)	
Breastfeeding, *yes, n*	26	

[1]Mean and standard deviation; range in parentheses.

Our final sample consisted of 7 normal-weight women (BMI range: 17-23), 12 overweight women (BMI range: 25-29), and 12 obese women (BMI range: 30-37). Most women did not have any formal employment. Of the two women who worked, only 1 worked 6 days a week and the other worked part-time. In this community, it is common for women who marry to move into their in-laws' house, and 65% of the sample reported living in the same house with her in-laws or her parents. Only 3 women had stopped breastfeeding; all other women were practicing varying degrees of breastfeeding, from on-demand full breastfeeding to token breastfeeding (breastfeeding at night, at nap times or when fussy).

3.3.1 The cultural model: the ideational dimension

I identified eight basic concepts that underlie child feeding behaviors. These are the concepts that guide women's explicit and implicit decisions about what to feed their children. The concepts along with the rationale are summarized in Table 3.2.

Table 3.2 Basic concepts of child feeding in a sample of Mexican women.

Concept	Rationale	In vivo code	Translation
Probaditas	Women begin with *probaditas*	*"probaditas"*	"tastes of food" "try foods"
Prepare foods separately from family food	Young children do not eat adult foods because adult foods contain *chile*	*"le preparo aparte"*	"I prepare [foods] separately [for the child]"
Indicators of child readiness to eat solid foods	Child's level of preparedness to eat solid food	*"dientes", "señas",* *"doctor aconsejó"*	"teeth", "gestures" "physician advised"
Appropriate Consistency	Child foods have an appropriate consistency (soft, semi-liquid, liquid)	*"machacado", "pachurrado"* *"raspadito"* *"bien molido" , "colado", "puré"* *"puro líquidos"*	"finely chopped" "mashed" "pap" "puree" "just liquids"
Child's food preferences	Preparing the foods the child enjoys eating, so that the child will eat	*"lo que le gusta"*	"what she likes"
Variety	Feeding different foods and varying the method of preparation	*"trato de variarle" "irle cambiando"*	"try to vary it" "change it"
Cost	Lack of money influences decisions about which foods to prepare	*"cuando hay", "cuando tengo", "no me alcanza"*	"when there is [money or food]", "there isn't enough [money]"
Healthiness of foods (positive and negative)	Positive foods contribute to child health. The negative foods could potentially cause ill health	*"frutas, verduras, leche" "cocino con poco aceite", "churros", "refresco", "el granito le hace daño"*	"fruits, vegetables, milk" "I cook with little oil", "fried dough", "sodas", "bean is harmful"

Probaditas

Women used the *probaditas* (tastes of food, try foods) to describe the first time they gave food. When I asked *cuando empezo a comer* (started to eat), most women responded by saying "I started *probaditas*…" Even when women spoke of having received advice from health professionals they used *probaditas* to describe first foods.

Women described *probaditas* as small amounts of food, and were mostly fruits, vegetables, soups, and broths, although some women reported a fortified fresh cheese product, Danonino (from Danone), and a probiotic beverage, Yakult, and Gerber jarred baby foods. If women were eating a food that could be appropriate for the child, the child would get that *probadita*.

> I gave her *probaditas* because we would eat and sometimes it seemed like she wanted it and I would give her. (Juana, daughter, 16 mo
>
> I would give her *probaditas* when I would feed her from my plate. (Leandra, daughter, 11 mo)

The purpose for *probaditas* was so the infant's stomach would comfortably adjust to solid foods and progressively eat more. This also helped to prevent gastrointestinal discomfort, *empacho,* and ensure the child accepted foods later on.

> [I started] with very little. The bean broth and I mash it, no more than 3 teaspoons. I don't give her much. (Monica, son, 5 mo)
>
> My mother in-law says that I should feed him slowly and for right now just stick with *probaditas*. (Tulia, son 9 mo)
>
> I started [*probaditas*] at 3 mo almost. I gave him banana….i would give him a little bit and like that by 6 mo, he was eating more, he was eating things. (Liliana, son, 13 mo)
>
> Well, when he's small like this [7 mo], we need to give him *probaditas*, not much so he doesn't get *empacho*. Not to give him a lot only 3 times a day, to try, so his stomach begins to accept food. (Lidia, son, 7 mo)
>
> [My mother] said that I shouldn't give him anything until he is 1 year because they get *empacho*, they get sick. You give them food—you give them

> everything after one year. At the health center they told me to give food at 6 mo. The nurses told me to give *probaditas* and if you don't give them before [one year] they won't eat. You give them so they will try vegetables. They said first vegetables and then fruit, little by little. (Martha, son, 16 mo)

> Children should eat all types of *probaditas* so that when they are older they will accept [food]. My oldest child doesn't eat vegetables. He doesn't want them. He eats a lot of fruit, broths, soups but the vegetables, he doesn't want them. So now, with this small one [referring to the baby], I give him *probaditas* so that he will know vegetables and will start eating them little by little. (Lidia, son, 7 mo)

Readiness to eat solid foods

I asked women how they knew their child was ready for solid foods. The response to the question revealed that they relied mostly on two sources of information to make their decision, the child and a physician.

Twelve women cited presence of teeth and hand or body gestures for starting solid foods.

> [I started feeding] at about 5 months because he had his teeth. At 3 mo, he had two of his bottom teeth and two top teeth. (Nadia, son, 17)

> Well, I saw that she wanted to eat, she asked for things. Like if she was anxious to eat. And I also saw that she had his 4 teeth, bottom and top, and I tried feeding her. (Liliana, daughter, 13 mo)

> [I started *probaditas*] very recently because she didn't have teeth yet. His teeth came out almost at 8 mo. He just started eating at around 9 or 10 mo. (Guadalupe, son, 14 mo)

> [I started feeding] because she wanted to eat and I would give her *probaditas* and she would do this [hand gesture as reaching food] or pinch the table, and she would chew. (Ari, daughter, 12 mo)

Advice from health professionals, mostly physicians and a few nurses, was the other main reason women started solid foods (n=12). Of the women whom received timely advice, 9 stated to have followed advice on when to start feeding and what

foods to give; 3 of these women were enrolled in the Early Stimulation Program[10]. Even though they had received advice from a physician, not all followed the advice.

> Well, I haven't fed her anything yet. I saw the doctor and she said to start feeding squash. But I haven't given her that. (Myra, daughter, 5 mo)

Other reasons for starting solid foods were 'baby was still hungry after breastfeeding' (n=1), 'away from child for extended periods of time' (n=2), 'ready to receive food at 12 mo' (n=1), 'advice from the grandmother' (n=1).

Prepare food separately

On the first pass of the data, there was a recurring term "le preparo aparte" ("I prepare [food] separately [for the child]") that was linked to a broad idea of child-appropriate foods. I asked the women to tell me about the different type of foods they prepared for the family, and it was often in response to this question that the women would have me clarify, "for the children or for the adults" or where the phrase "*a ellos les preparo aparte*" would be used. Women were explicit that a young child could not eat *chile*[11] and that adults ate foods prepared in *salsa* that contained *chile*. The *salsa* was prepared by placing tomatoes, onions, and *chiles* in a blender to achieve a thick soup-like consistency. When women prepared these foods in *salsa*, they also stated to have prepared food separately for her young children. To 'prepare separately' was not only about preparing different types of foods but also about serving the same family food, without *salsa*, to the child.

> For them I prepare separately. For example, yesterday I bought chicken and I made it with dry *chile* and for them I made soup. (Ari, daughter, 12 mo)

> If we eat *chile*, we prepare separately a broth. If we eat pork we don't give him [baby]. When I buy chicken, I make a broth for him and for us [chicken] in

[10] The early stimulation program is offered to women with children at high risk for malnutrition.

[11] *chile* are fruit of the *Capsicum* plant and used as a spice. In Morelos, the most common *chiles* are jalapeños and *chile* de *arbol*

salsa. (Ana, son, 7 mo)

So that we all eat, a soup, or a *chile* sauce separate for us. (Gina, son, 18 mo)

[I don't give] for example, pork meat, stuffed *chiles*, or whenever I make something spicy. (Juana, daughter, 16 mo)

When I make chicken broth, I cut the tortilla into small pieces and add it to the broth. I prepare the broth the same way, but his, I serve his special for him. (Ana, son 7 mo)

Appropriate consistency

When I asked women to talk about the type of foods they prepared for the young child, the consistency of food was clearly discernable in their responses. Also when discussing the types of foods they first introduced, women made specific references to consistency. They used that food attribute to make decisions about what to feed young children. Carol made 'soup' into a verb to describe her young children's eating habits: *"mis hijos sopean"*. Two women highlighted the importance of food consistency in making feeding choices.

My mother says we should give food that is mashed, liquids so that they can eat well. They are accustomed to drinking things. She says I should try to give them natural water, *agua fresca*,[12] not too sweet so they do not become accustomed to what is sweet. (Susana, son, 16 mo)

[I've started feeding] all types of juices, orange juice or whatever fruit I have. When I make *agua fresca* I give him some so he can try. Broths, soups, bean broth. (Lidia, son 7 mo)

In addition to the liquid or semi-liquid consistencies, women noted that solid foods should be mashed or finely chopped for children. They used the word *papilla* (pap) to describe food in pap form, often making reference to a Gerber-like

[12] *Agua fresca* is freshly squeezed fruit juice (e.g., lime and oranges) or pulp which is obtained by using a blender (e.g., melon, strawberries, and pineapple), water, and sugar to taste.

consistency, or when they referred the Nutrisano pap (fortified milk poweder provided by *Oportunidades* program) available at the health center. Pap, similar to Gerber jar baby foods, if given, were first foods, cooked and strained fruit or vegetables. Soft foods such as yogurt and puddings were considered appropriate for infants and children. Women spoke about how they gradually transitioned children from pap or mashed to finger foods such as cut fruit and pieces of tortilla.

> When he was 5 mo we gave him the noodle soup mashed. The smallest we could get it. Now I give him soup, beans, and I gave him the vegetables finely diced because he doesn't bite well. (Tulia, son, 9 mo).
>
> I boil it [the spinach] and with its juice I mash it and then I strain it and give it to him. (Aura, son, 7 mo)
>
> [At 5 months] I mashed the chicken the broth with vegetables, the soup with vegetables and chicken and like that. (Mary, daughter 16 mo)
>
> The mango and apple, I give it to her in pieces because she doesn't want it mashed. (Ari, daughter, 12 mo)
>
> I make her a *taco* and I place it in her hand and she eats it, even if it is only to tear off pieces [with her mouth] but that's how she learns. (Juana, daughter, 16 mo)

In the home observations, I watched how women used the back of the spoon to mash all types of food or used the edge of the spoon to cut foods into small pieces. Only two women talked about using a blender to make a pap, but I never observed the blender used for this purpose.

Variety in diet

Women discussed the importance of providing different types of foods, exposing the child to new foods and establishing good eating behaviors. *Probaditas* were important for achieving variety as already noted.

> We have to give them different foods, it think, teach them to eat more of everything, give them varied food. (Ivonne, son, 6 mo)

> I give him one day yes, one day no because I vary it. One day it's rice, another day potatoes, another day beans, one other day broths. The soups are made with pasta. I vary it because each soup has a different taste. Sometimes I give elbows, noodle, sometimes letters. (Nadia, son, 17 mo)

> My mother used to say that I should feed everything because when he's older he will not eat. And she's right because when he was little and I didn't give him that, now he doesn't like it. (Nadia, son, 17 mo)

Variety in the child's diet was related to variety in the foods purchased for the family consumption, as noted by Juana and Tulia.

> The meats, fish, chicken, vegetables and fruit, beans, lentils, rice, well that's what we mostly eat. Try to vary it, making it one way and then another. (Juana, daughter, 16 mo)

> I vary it. If this week we eat sausage this week, next [week] we eat *cecina* (dried meat), and like that. (Tulia, son, 18 mo)

Child's food preferences

What the child liked and did not like guided what foods were offered and how they were prepared. For instance, when I asked women to state their child's favorite food, 11 women made direct reference to a soup or broth as the child's favorite.

> When I give her what she likes she eats it, and when I don't she throws it. (Juana, daughter, 16 mo)

> I only give vegetables when we I make the soup, for example carrots, potatoes, squash, and sometimes I give her *nopales*. That's all that she likes. (Liliana, daughter, 13 mo)

> I give it to her finely chopped because she doesn't like pap. (Cecilia, daughter, 15 mo)

Women in this community explained that reasons for food variety were important to improve acceptability of foods. *Probaditas* were key for ascertaining food preferences.

> I prepare things differently so that she doesn't get bored. (Graciela, daughter, 12 mo)

> If I eat fish, I give her to try to see if she will like it. On Sunday I had fish and I gave her to try. I use *probaditas* like that. (Liliana, daughter 13 mo)

Money

Not having enough money was a key consideration for our women. "When there is money", "when I have x food item" "sometimes there isn't enough" were frequent phrases. Money and food costs were part of their knowledge on how to feed children.

Milk, fruits, vegetables, chicken, and fish were some of the items purchased less frequently when there was not enough money. Women used several strategies to provide these foods to their children. Some said they bought "a little bit of everything" even if it was expensive. This strategy was mostly reported by women with one child. In households were there were two or more children, women adopted several possible strategies: (a) fed expensive foods less often, for instance fruits would be provided one day, vegetables another day and meat some other day, and in cases of severe money shortages, the adults would not consume these items; (b) substituted the expensive items with cheaper alternatives, or (c) bought cheaper items.

> If I don't buy fruit, I buy vegetables, and if I don't buy vegetables, I buy chicken. I try to combine a little bit of everything. With the chicken, I buy only the wings, the saddle, the foot and only when I have enough [money] I buy the breast. (Lidia, son, 7 mo)

> When I have enough money, I prepare [puddings] with milk, if not with water… I prepare a soup with chicken or at least with hard-boiled eggs… (Myra, daughter, 5 mo)

> The fruit, I get it only for my children because I can't afford to buy it for us. I wish I could give them fruit everyday but I just don't have enough money. I give it to them 4 times per week. (Carol, daughter, 14 mo)

> The fruits and vegetables for us [mother and father], almost no, we usually buy it only for them. (Ari, daughter, 12 mo)

> Well, because I give him a [chicken] bone to suck on, I buy a wing or the back. Sometimes, honestly, when I don't have, I buy the saddle, which has more fat, but I take it off. (Graciela, daughter, 12 mo)

> I'm buying a lot of bananas. Whatever is cheap. My sister says that I give my children too much egg, but it is what is cheap and it goes a long way. (Gina, son, 18 mo)

Healthiness of Foods (positive and negative attributes)

As women discussed what to feed children they made direct and indirect references to foods they considered healthy, unhealthy or harmful for their child. These ideas were also elicited by asking the women "if you and other women with young children talk about feeding your baby, what sort of things would you discuss?" The foods discussed positively and negatively as well as the rationale are summarized in Table 3.3. The rationale for 'positive' foods was shared by most women. With the exception of Yakult, most women said that if they had more money they would feed more of these foods. Two women specifically noted wanting to feed more soups and broths if they had more money.

There were 7 women that discussed negative foods. In regard to junk foods and carbonated beverages, one woman thought that junk foods were alright as occasional treats and two other women occasionally purchased fruit-flavored sodas. There was only one woman who stated that sodas could cause urinary tract problems. Although pork was considered not appropriate for young children, two women had given pork, and one woman noted feeding deli-style ham with scrambled eggs. Some women talked about using little oil in their cooking but did not state why they did so; only one mother talked about how rice was "heavy" because it required so much oil during cooking.

Table 3.3 Women's concepts of positive foods, negative foods, and their rationale

Positive Foods	Rationale
Vegetables	"helps children grow"; "helps with learning"
Fruit	"helps children grow"
Breast milk	"provides defenses"
Yakult	"it's good for children"
Milk	"good for their health"; "keeps them well fed"
Negative Foods	
Junk food: *churros*[1] and candy	"sticks to the stomach"
Carbonated beverages, Coke	*"mal de orin"*, urinary tract infections
Bean	"sticks to the stomach and causes indigestion"
Oil	"don't like to use too much"
Pork	"not good" for young children; "heavy"

[1]*churros* are deep-fried wheat dough sprinkled with cinnamon and sugar.

In sum, *probaditas*, readiness to eat solid foods, appropriate consistency, preparing foods separately, variety, child's food preferences, money and food cost, and healthiness of foods were the 8 concepts on how to feed young children. In the next section, I present a description of those practices.

3.3.2 Description of age-appropriate, typical practices

I elicited information on feeding practices by asking women when they started feeding foods, how often they feed certain foods, and describing what the child ate the previous day (24-h recall). I discovered two distinct feeding patterns, one for infancy and another after 1 y. The pattern for infancy had structure and sequence; these were not clearly discernable after 1 y.

In my sample, 10 women noted that they had introduced foods before 6 mo. These 'early feeders' started by either feeding fruits (apple, banana, guava, pear *raspado* "scrapped", grape juice) at 4 mo and then broths at 5 mo, or introduced fruits

and broths or soups simultaneously at 5 mo. Only two women deviated from these two patterns. Two women introduced Danonino at 3-4 mo, another woman Yakult at 4 mo. All women in this group introduced vegetables at 6 mo, except for one woman who started vegetables at 5 mo.

There was more variability around what was introduced among women who began feeding solid foods on or after 6 mo. Some women began feeding foods at 6 mo, others waited until 7 mo, and for this reason I classified the 'first foods' as those foods that were given between the 6-8 mo period. Women began feeding foods when they perceived their child to be ready for solid foods (i.e., chewing motion, presence of teeth) or if they had interpreted their child's body language as 'asking' for foods. Advice from physician or family member was also an important consideration. Women who reported timely advice fed more vegetables and flesh foods.

Between 6-8 mo, the 'first foods' were fruits (apple, banana, pear, grapes [drops of juice squeezed directly from the grape into the child's mouth]), broths[13] (bean or chicken) and soups[14] (prepared using wheat noodle or rice), and vegetables (chayote squash, zucchini squash, potato, carrot, green beans, and spinach). Five women noted Dananino as one of those 'first food', and 5 women mentioned giving unsweetened fruit juice and Gerber (fruit). Other, very infrequent behaviors included adding pieces of tortilla, chicken meat, or eggs to the broth. All solid foods were given

[13] Bean broth is the water where the bean has been cooked, and the water is usually seasoned with salt, espazote (herb), and onions. The chicken broth is can be prepared by frying tomato, onions, then adding water, cumin, espazote and salt.

[14] Soups, or *sopas aguadas*, are prepared using thin wheat noodles or rice. The noodle and rice are fried lightly until slightly brown; tomato, onion, and garlic, all crushed in the blender, and bottled water are added. Because of the noodles, soups have a thicker consistency and stay on the spoon more easily than a broth. Most women prepared the soups using fresh ingredients but I observed 2 women use a cube of Knorr bouillon seasoning for flavor. In one home observation, the woman noted she bought the Knorr cube when she didn't have enough money for tomatoes or chicken. Women also talked about vegetables soups which are prepared similarly to *sopas aguadas* except that they do not have thin wheat noodles or rice.

mashed or as a pap at this age.

> I prepare soup with chicken but I gave her only the soup, not the chicken. (Marilu, daughter, 8 mo)
>
> He mostly eats bean broth, chicken broth and soups. (Amalia, son, 7 mo)
>
> I started fruits at 8 months. I started with *probaditas* of banana. Soft foods. Bananas, papaya, scrapped with the spoon. The vegetables were also around 8 mo. I would make him vegetable broth or I would make chicken broth with vegetables. They hardly eat vegetables, but the broth they do eat that… (Susana, son, 16 mo)

The order in which women introduced the fruits, vegetables, and soups and broths varied between 6-8 mo. There were 4 distinct patterns of food introduction (Table 3.4). It was not apparent from the data that one pattern was less common than the others, except for pattern 4. Women exhibiting this last pattern had participated in the Early Stimulation program or followed feeding advice from a physician.

From 9-12 mo, women added other foods, but the base of the diet continued to be soups and broths, fruits, and, to a lesser extent, vegetables. Very few new foods were added to the diet during this time.

Table 3.4 The 4 patterns describing the order of introduction foods from 6-8 mo.

Order of introduction	**Pattern 1**	**Pattern 2**	**Pattern 3**	**Pattern 4**
First	Broths and soups	Fruit Broths and soups	Fruit	Fruit Vegetables
Second	Fruit Vegetables	Vegetables	Broths and soups	Broths and soups
Third	n/a	n/a	Vegetables	n/a

n/a: not applicable

Some women reported giving chicken, as a pap or mashed, wing or foot; a few

others gave tortilla, as a finger food or cut into pieces in the broth; and others gave *atole*[15]. Yogurt or Danonino were also provided; although *atole* and dairy were not reported by many women. In very few cases, scrambled eggs (served alone or in soup and broth) were given to the children from 9-12 mo. It was clear from the interviews that at this age soups and broths were the base of the meal and foods were added to them. This idea is also supported by the fact that most women perceived the child's favorite food to be chicken broth.

> I give her broth with vegetables and chicken…the chicken is cut into small pieces …squash, potatoes, carrots. (Dolores, daughter, 9 mo)

The diet after the first birthday. At 1 year, most said their child was ready to receive *comida*: "and *comida* when he is a year because he doesn't have teeth". The term comida was often associated with what was being fed after 1 y and to family foods.

> Well now she eats everything [laughs]. She eat chicken broth, egg, she started eating pork, meat *tamal*[16], everything that an adult eats. (Cecilia, daughter, 15 mo)

Variety improved at this time, but soups and broths were given almost every day.

> Well for food, I make mostly broths, chicken broth, only white with tomato and onions, and when I have rice, I put it in the broth. She loves to eat beans with eggs. When I make tortilla I give her. I give her soups, but it's almost always broths. If I eat some *cecina*[17], I give her a piece. (Rosy, daughter, 12 mo)

The chicken broth mostly had chicken, but vegetables could be added; and the soups could have chicken, vegetables or both. The bean broth could include the bean

[15] *atole* is a beverage (nectar consistency) prepared from corn, rice, or oatmeal that is boiled and cooked for an extended period. It is usually sweetened with sugar, and milk may be added.

[16] *Tamal* is made from cooked, seasoned corn dough wrapped in leaves (plantain or corn husks), which is then cooked some more. In this area of Mexico, *tamal* is filled with red or green tomato sauce and pork or chicken.

[17] Cecina is a thinly sliced beef that is marinated and sun-dried.

(but this was highly variable practice) and tortilla. Lentils were cited only twice in our sample.

Vegetables and Fruit. It was common for women to purchase a 0.5 kg bag of mixed, cut vegetables (broccoli, cauliflower, peas, corn, and cabbage), and to achieve a soft consistency, these were added to the soups or broths. In addition to the squashes, carrots and potatoes, which many women had introduced in the latter half of infancy, broccoli, cauliflower, peas, and cabbage were new vegetables added to the diet after the first birthday. *Nopales*[18] were given to some children. Some women delayed the introduction of vegetables altogether until the child was 1 y and could chew soft foods. Two women with children 12-18 mo did not yet give vegetables. Women who gave vegetables reported feeding their children vegetables 2-4 times a week.

Only 3 women reported feeding fruit every day. Otherwise, fruits were provided 2-3 times a week. Most women reported buying what was in season because it was cheaper.

Chicken, beef, fish, and eggs. Chicken was the most popular and the most frequently given flesh food (2-3 times a week). Beef and fried fish were considered child-appropriate foods, but they were provided infrequently (1-2 times a month), except one mother who gave fish 2 times a week because "she [Diana's mother] gives it as a gift". Only two women reported feeding pork to their children. Also, children were given eggs anywhere from 1 to 3-4 times a week. Scrambled eggs could also be accompanied with tortilla, bean, or rice. Fish, though rarely fed to the children, could also be given with tortilla.

[18] Nopales are the pads of the prickly pear cactus whose thorns have been removed. The pads are usually sliced and then cooked.

Dairy products. Cecilia noted "the milk, whole, we don't give that until they are 1 y old". After 1 y, powered cow's milk was commonly consumed by the children either in a cup or bottle and often sweetened with sugar (7 women gave Nido Kinder, fortified milk, from Nestle; and 2 gave Liconsa, fortified milk distributed by the Mexican government). The amount consumed varied considerably, from 120 mL only in the morning to 720 mL given 3 times/d. This depended on how much food the child was eating and if they were still breastfeeding. Marta, who was weaning her son from breast milk, said "he drinks 6 or even 7 ounces (180 or 210 mL), when he doesn't eat. But when he eats, he doesn't drink much." Only one mother stated she could not afford to feed powdered cow's milk every day, and yet milk was cited as being one of those foods that would be offered more frequently if there was more money. Women who gave milk infrequently offered *atole*, Danonio or yogurt on a daily basis. Gina told me "I hardly give him milk, I give him yogurt…he eats ½ container every day".

Heavy cream and cheese were also given to the children. Cheese could be given in the bean broth. Cream and cheese were often used as garnishes to *chilaquiles* (thin tortilla fried with tomato sauce), *picadas* (1 cm-thick tortillas topped with tomato sauce), *sopes* (similar to *picadas* but can have meat toppings and refried beans and are also garnished with tomato sauce). One mother reported preparing spaghetti with cream and cheese and I observed one mother prepare this as the meal for her 7 mo-old son.

Atole and pudding. Atole and puddings were child-appropriate because they were soft and could be prepared with fluid cow's milk. The puddings were usually prepared at home from store bought packages, although a few women purchased puddings from street vendors. One woman reported soaking a piece of bread in the *atole* and then feeding that to the child; while another woman reported soaking a piece of bread in her glass of milk (this child received milk rarely). *Atole* or puddings made

with milk were given anywhere from once per week to everyday as were yogurt and Danonino, and the data seem to show that their frequency was related to whether or not the child received powered cow's milk. *Atole,* when given, was fed either in the early in the morning or late in the evening. Puddings could also be given in the early part of the morning or fed throughout the day, in between meals.

Tortilla and rice. All women with children 12 mo or older reported feeding tortilla every day. The tortilla was large and thin and made from white corn that had been soaked in calcium carbonate. It could be prepared at home or purchased from other women who sold tortillas for a living. Women cut the tortilla in half, rolled it using the palm of their hands, and placed it into the child's hand. The rolled up tortilla was referred to as *taco* and often served as an accompaniment to savory foods. The tortilla could also be cut into small pieces and served in the soup or broth. Other ways tortillas could be prepared were as *picadas*, *chilaquiles*, or *enchiladas*[19], but these now became meals. These were child-appropriate foods because the tomato sauce softened the tortilla enough so the child could chew it easily. In some cases, a piece of tortilla with salt was given between meals.

> Sometimes I make *chilaquiles*, but without *chile*, or *picadas*. They like *picadas*. (Susana, son, 16 mo)

> Throughout the day, she will eat two Danoninos, a yogurt, a piece of tortilla with salt. (Roxana, daughter, 14 mo)

Rice was part of the diet but mostly provided in soup or *atole*. But rice prepared for the family could also be consumed by the child and served as an accompaniment to beans, egg, or meat. Juana said that she added water to the rice in

[19] Enchiladas are large corn tortillas lightly fried. The fried tortillas is taken out of the pan and then filled with chicken, rolled up, and garnished with heavy cream, cheese, salsa, and lettuce. When money was limited, women reported enchiladas de tortilla, which meant that there was no meat filling.

the child's plate if the rice was dry. Some women pointed out that rice was a choking hazard and thus they preferred the very soft consistency achieved in soups. One woman said she avoided rice altogether until after 2 y. How often the child received rice was determined by how often the mother prepared rice for the family.

Meal structure. Women talked about how children needed to have a feeding schedule or what they called "feed at his hours", and this schedule was often dictated by the child's sleeping patterns and the family's meal times.

> In the morning she had her milk [powdered cow's milk]. Then she woke up [from morning nap] and I gave her a little bit of chicken. Then later she went to play, I bathed her, she went to sleep and I gave her milk. In the afternoon when she woke up, I gave her to eat rice and a little bit of *agua fresca*. In the afternoon I gave her milk and that's it. (Liliana, daughter, 13 mo).

> I feed him *almuerzo* at 12 pm when my other baby comes home. (Lidia, son, 7 mo)

> His sister comes home at 12 pm and I sit him down to eat and he eats more then. (Gina, son, 18 mo)

From 6-12 mo, children were served 1-2 meals/d. Fruits, Danonino, *atole*, or Soups and broths were often the foods that were fed at *almuerzo* or *comida*; only one woman reported feeding crackers between meals. After 1 y most children received 2-3 meals/d, *almuerzo, comida, or cena*. Most often, *almuerzo* and *comida* were savory, consisting of grain and dairy (e.g., *taco* with cheese or *picadas*), grain and meat (e.g., rice with chicken), or soups and broths with grain, meat, or egg (e.g., soup with tortilla, broth with chicken, bean broth with egg). However, there were instances when women fed fruits, Danonino, and Yakult at meal times. *Cena* was more variable because it could be savory foods, such as those served at *almuerzo* or comida, but milk served in a cup or bottle (n=2), a piece of fruit (n=2), atole (n=1), or breast milk (n=1) was also noted. Fruits, Danonino, puddings, Yakult, fruit juice, *agua fresca,* and saltines were fed between meals. If *atole* was provided to the child, it was often fed in

the early part of the morning (as part of *desayuno* or breakfast), shortly after waking up. Women never referred to feeding between meals as "*entre comida* (snacks)".

In summary, infants and young children in our study received broths, soups, fruits, vegetables, chicken, fish, beef, eggs, milk, yogurt, Danonino, Yakult, *atole*, pudding, tortilla, rice, and beans. One mother summarized her child's diet by saying "well he eats soups, a little bit of vegetables, broths, milk. That's all" (Rocio, son, 17 mo).

3.3.3 Social organization of the home: a key determinant of feeding practices

Women enacted their knowledge about feeding children to the lived social realities of the home. Women shared how household finances, children, and food preferences influenced in large part how food was prepared and how often the young infant or child was able to eat a particular food item. Although 35% of our participants did not live in extended families, women still discussed how feeding advice from family members influenced and supported some of their feeding decisions.

Household finances. In this low-income community, money, in addition to being part of maternal knowledge about child feeding, significantly affected household food purchases, which in turn affect child feeding practices. Household finances may explain differences in practices.

> Well sometimes we don't come to the market because there isn't enough [money]. When there isn't enough [money] we have to eat simple things. (Roxana, daughter, 14 mo)

> You know, sometimes one doesn't prepare things. For example, there are times we have breakfast and other times we don't. If I had more money we would be better nourished. I would prepare *atole* for breakfast every day. (Liliana, daughter, 12 mo)

> To be honest, sometimes I only buy for my little girl because there isn't enough for all of us. But when I find things that are more or less cheap I bring it and then there is enough for everyone. (Graciela, daughter, 12 mo)

> Sometimes when I have money I buy milk (Mary, daughter, 16 mo)

When there is money, [I buy] mandarins, pineapple, mango. (Lidia, son, 7 mo)

Yet having more money to purchase foods would not change the women's knowledge of healthiness of foods, variety, food preferences of the child, prepare foods separately for the child, consistency, readiness to eat or *probaditas*.

> We all aren't the same, some give other things. Some women say they don't have money to buy chicken. A lot of women say this "I don't have, and she will have to eat what there is". So they don't have enough [money] to make food separately. (Lizeth, daughter, 16 mo)

> [if money was not a problem] I would prepare his soups, his broths. (Aura, son, 7 mo)

Women talked about food gifts or "*nos regala*" ["she gave us"] as avenues to bring food into the household. The data revealed that mother-in-laws and grandmothers gave fish, vegetables, or *pozole*, which were then fed to the children.

Young siblings and father. There were two key factors related to in the social organization of the home that reinforced the women's conceptualization of child feeding practices, the presence of small young children and husband for meal times. Because many of the fathers were employed as day laborers they only ate *cena* at home. Analysis of the woman's 24-h recall data revealed that the evening meals, when the husband was home, were more likely to have a meat dish prepared in salsa with *chile*.

If the woman had young children, it just made more sense to prepare meals that all young children could eat. For Carol, this meant that food preparation was much easier since what she prepared for one, all the other could eat:

> It's not hard, because I have to make it for my other children. I make double food because I have other children and I have to make something nutritious for them. We [adults] can eat just *salsa*…

Lidia noted feeding her 7-mo old son "the soup [she] gave [her] other son."

These meals of course, because they were different from adult meals (i.e., did not have *chile*), needed to be prepared in advance as Rocio noted, "I just have to

prepare [their meals] earlier". Most women just accepted that they needed to prepare two separate meals when the husband was home.

> In the evening, I usually prepare her own food. What I mean is we make ours in salsa. (Juana, daughter, 16 mo)

Food preferences. Food preferences affected food purchasing decisions. In situations where the mother did not like vegetables she prepared them very infrequently. As one woman distinctly put it, "what I eat most is what we eat". If her small children had particular preferences or aversions, she was also less likely to make these food items. All these considerations were reflected to some degree in the child's diet. For example, Gina had a 5 y-old daughter whose preference for potatoes prepared as home fries dictated the types of vegetables mom purchased at the market: "my daughter doesn't eat vegetables and I give them what they eat." Gina's son received other types of vegetables only once per week.

> We don't eat a lot of vegetables, almost rarely, maybe once per week when I make chicken broth with vegetables or beef broth with vegetables. We don't make vegetables, we eat more meat than vegetables. We eat meat and eggs. (Monica, son, 5 mo)

> I don't like fruit. My husband scolds me because I don't buy him fruit. I don't like it. In my mother's house she hardly bough fruit and I became accustomed to it, my body doesn't ask for it and I don't like it….My husband buys the fruit for him and the children...I didn't eat vegetables either. I've started eating them here. (Aura, son, 7 mo)

Advice. Advice or verbal messages from grandmothers and mothers-in-law were one mechanism through which knowledge was shared and behaviors were reinforced. Aura noted, "well they tell me what I should feed and that I should keep his things clean so he doesn't get sick." Ivonne noted, "when he was 4 mo, my mother said 'it's time to start feeding'. That's mostly what she would say, to give him the chayote [squash]." In one case the grandmother advised: "not to feed the bean, it's

better only to give the broth...so I give him only the broth" (Liliana, daughter, 13 mo). Advice could also take the form of terse or more direct verbal messages about what the child should be consuming: "my mother-in-law, well she sends me to make him his soups, his broths" (Marisol, son, 16 mo).

3.3.4 Social and physical environment: availability of food

All women reported buying their food at the local, open market. The market was downtown, next to the central square and cathedral. Most women were within walking distance from the market, but those who lived farther away would take a motorcycle taxi to the market. Vendors were there every day. Most women reported visiting the market 2-3 times per week, although some went every day and others only on Sunday, when the market offered a greater variety of food. Only 5 reported buying foods from larger towns located about 20-km radius from the community. Two of these women went at least once a week, and the other 3 reported that their husbands would bring sweet bread or milk from the towns where they worked.

The local market afforded women some flexibility in price and selection. As noted, women did not need to buy an entire chicken because vendors sold chicken by the piece. Also, women could purchase one apple or one squash if they needed to make something only for the young child. Food purchased at the market was cheaper—1 or 2 pesos cheaper than the local store. Manufactured foods such as Danonino, Yakult, yogurt, juice, carbonated beverages, powdered milk, and pasta were readily available at the market and local stores.

Local stores sold mostly manufactured items (e.g., pasta, dry breakfast cereal, powered milk, canned *chile*, potato chips, carbonated beverages, candy, etc.). Some stores had refrigerated storage, usually provided by large beverage or dairy companies, and so they stocked yogurt, cream, cheese, and juice. Local stores were ubiquitous and no woman lived more than 5 blocks from one. *Cremerias* were larger than the local

stores and sold mostly diary products and processed meats, in addition to other manufactured perishable and non-perishable goods. There were fewer c*remerias* than local stores, and most of the *cremerias* visited by our participants were located in the town center, not far from the market.

Tortillas could be purchased in the neighborhood from women vendors, but most women bought the white corn in large sacks, soaked the corn in calcium carbonate, took the soaked corn to the local mill, and prepared the tortillas at home. In my study, two women earned an income by selling tortillas.

In summary, maternal knowledge and practices were embedded within a larger system of food acquisition. I did not find the physical and social environment to differ between the women so to modify the types of foods offered to children. Even though access to the larger cities was facilitated by bus and highways, very few women bought food outside of Xoxocotla and those that did, purchased the same foods available in Xoxocotla.

3. 4 Discussion

Using ethnography and through eliciting meaning, I have identified eight key concepts that provide a 'how-to' for complementary feeding. I have shown the relationships among the concepts, how they are implemented, and the factors that influence feeding practices. I have provided a rich description of feeding practices, particularly patterns of introduction of foods. This information is often not presented in detail in published research. In short, I have elucidated which foods are likely to be prepared for the child and why. This link is rarely made explicit in descriptive studies of complementary diets (17), formative research (18), or research on the psychosocial determinants of complementary feeding (19, 20). Moreover, the methodology offered a new lens from which to view complementary feeding practices: knowledge of how to feed young children is systematic and complex, a conceptual framework with rules

and logic.

In this community the rules for feeding children were as follows. Women start feeding solid foods with *probaditas*. They feed small amounts of food to introduce the young infant to new foods and to avoid her getting sick. A woman knows when the infant is ready to start *probaditas* by being attentive to the infant's behavior, following a physician's advice or listening to the advice of family members. Women may use a combination of these strategies to decide when to start foods. A woman must prepare foods separately for the child given that adult foods should not be fed to young children as they likely have *chile*. The appropriate consistency for 'first foods' are thin and thick liquids (e.g., broths, soups, and *atole*), mashed, pap, and soft. As the child's motor capacities (e.g., chewing and teeth) improve, women transition them to the family diet, but those first food remain appropriate for all young children. In fact, it was common for siblings were ≤ 5 y to receive the soups prepared for the young child. Child-appropriate, family foods are those food that do not have *chile* and are semi-liquid (e.g., *sopas aguadas*), liquid (i.e., broths), or soft consistency (i.e., eggs, *chilaquiles*, *sopes*, *picadas*, rice). A woman must ensure sufficient variety in the child's diet, giving frequently the healthy foods and avoiding the negative foods, to ensure good growth, development, and to some extent help establish good feeding behaviors. Preparing the foods the child enjoys eating is crucial for food acceptability. Knowledge of money and food costs was important in deciding what foods to purchase and prepare. That women discussed healthiness of foods and coping strategies for financial constraints provide evidence of an underlying logic, or cultural theme, governing the knowledge structure. The cultural theme was how to best feed the infant to ensure good nutrition, health, and growth. These beliefs guided practices.

Once the cultural rules for feeding children were learned, a woman put the rules into practice, but exactly how this happened in our sample was a function of

household finances, household structure, advice, and food preferences. In fact, women noted how they prepared food differently from other women. The difference they perceived, however, was not from a divergence in the cultural rules but, as I have shown, from differences in their proximal social factors. Household finances were an important factor that determined what and how often foods were provided, which was the basis for the cognitive rules on money and food costs. Preferences of the child, young siblings and of the mother influenced the child's diet, and when the household economy was limited, preferences were accentuated insofar as the mother could not satisfy all of them and so one preference became dominant. In this study, the presence of young siblings and father helped to reinforce the use of soups, broths, and other soft foods for young children.

Family members' food preferences suggest that women used foods available in the home to prepare foods for their young child. Using a sample of women living in a small city 15 km southeast from Xoxocotla, researchers at INSP also reported that the family diet and food preferences of family members influenced how often flesh foods were fed to the child (18). In Guatemala, rural women reported feeding household foods to the 6-12 mo old infants (17). My findings on maternal food preferences and their influence on complementary foods has been reported by others in the U.S.(21, 22), U.K. (23) and Mexico (24).

The data did not show a strong influence of the grandmother or mother-in-law in the day-to-day decisions about child feeding. This is contrary to what others have found in this community (Lynnette Neufeld, personal communication, July 7, 2010). It is possible that women did not want to reveal that the mother-in-law was an important actor in child feeding decisions or that the influence of the mother-in-law is so customary that it is not perceived to be salient to the participants and therefore not reported. Nonetheless, mother-in-laws were crucial for helping to establish the

cultural rules and supporting practices. The matriarchs were key in helping to decide when it was time to start feeding and what to feed. In Malawi, Bezner Kerr et al. (25) also showed that the paternal grandmothers were key decision makers on when to start feeding foods. Guerrero et al. (7) also reported that mother-in-laws and grandmothers provided a substantial proportion of the child feeding advice (37%).

The diets of the young children in our study mostly consisted of chicken and bean broth and soups with thin noodle or rice. To these soups and broths women added vegetables, tortilla, with chicken meat, if they were >1 y, and less frequently, scrambled eggs or beans. The use of soups as a vehicle for animal source foods has been previously reported in Mexico (18). Tortillas were fed everyday either on their own or prepared as a meal in *picadas*, *enchiladas*, and *chilaquiles*. Fruits were given more frequently than vegetables, and in contrast to vegetables, mothers noted that their child had a preferred fruit. Because so many of the children were still breastfeeding on demand and because milk was an expensive item, cow's milk (powdered or fluid) was not consumed everyday by all young children.

There was substantial variability in how frequently dairy products and foods prepared with milk were provided. I did not ask specifically why women preferred to prepare or purchase these items, nor did women discuss this. It is plausible that given the limited number of food groups children are able to consume, these may add variety to the child's diet and are because they contain milk and for their consistency. Furthermore, Danonino is marketed as nutritious products made with milk and added vitamins and minerals to help achieve a child's maximum growth potential. Yakult, which was also consumed by the children in our study, is marketed to help maintain gastrointestinal health. The health claims for both products may be reasons why women feed them.

The cultural appropriateness of liquid-based foods has been also reported in

Guatemalan infants ages 6-12 mo. Enneman et al. (17) found that within a 24-h period about half of the food items offered to infants were soups, stews, and liquid-based foods, with no statistically significant differences between urban and rural settings. The authors also noted that tortilla, pasta, rice, squash, and bananas were given frequently. In their sample Afro-Colombian women, 75% reported soups as the first food (8).

Household finance has both an ideational and a social dimension, with women perceiving their social realities and creating knowledge to deal with these realities. The financial ideational dimension should not be regarded as innate. The household financial constraints occur within the food producing system that is currently in place in Mexico, a system constructed largely by historical, social, and global socio-political factors (26). This socially constructed, ideational dimension of money and food costs acknowledges a woman's agency and her lived experiences.

The data shows that the complementary diets of children include core, secondary core, and periphery foods. Passin and Bennett (27) describe core foods as regular, important, and consistent; secondary core foods as part of the diet but do not have the importance of core foods; and periphery foods as least common and infrequent in occurrence, characteristics of individuals and not of groups. Based on these definitions, in this sample, one could classify broths, soups, and tortilla (especially after 1 y) as core foods because at least one of these items is offered every day. Secondary core foods are fruits, vegetables, milk, flesh foods, beans, and eggs because these items were fed a few times per week, and were given up or fed less frequently when financial resources were constrained. I did not see this with the core foods. Periphery foods are the Danonino, Yakult, *atole*, puddings because only some women offered these foods.

Special meanings are attached to core foods (28). Tortillas are core foods

because they are a dietary staple in Mexico. The link among the cultural rules of "prepare food separately", "variety", and "consistency" may explain why soups and broths are core foods even though they are not staple foods neither key family foods. One would expect fruit and cow's milk to be core foods in populations with more financial resources, particularly cow's milk for non-breastfed children.

Core foods are also resistant to change (28). The current recommendation to feed semi-solid and solid food does not fit with the conceptual structure of liquid-based foods in this community. I have provided rationale for why liquid-based foods are considered appropriate in this community, and interventions aimed to improve the consistency of the diet need to recognize the cultural significance of liquid-based foods.

Categorizing the child's diet into core, secondary core, and periphery food further helps to understand complementary feeding practices in this community. For example, how women conceptualize variability is not at the level of day-to-day, but at the level of week-to-week, and thus secondary core foods are important for achieving a desired variability in the diet. Dietary assessment methods that rely on intake in the previous day may underestimate intake of fruit and vegetables, and animal-source foods in this community (29). Furthermore, public health recommendations for feeding of orange fleshed fruits, green leafy vegetables, or animal-source foods every day might not fit with their concept of variability or be within the financial capabilities of the household. On the other hand, secondary core foods would be the foods most amenable to change (27).

Using 24-h recall, researchers at INSP assessed the complementary diets of children 6-24 mo in a small city about 15 km southeast of our community (18). They showed that 28%, 66%, 68% of breastfed infants were not meeting the requirements for energy, iron, and calcium, respectively, but they did not report the types of foods

children were receiving. It is plausible that a proportion of the children in this study may also not meet the requirements for energy, iron, and calcium as their diets lack may lack some of the foods that are good sources of these components (18).

It is important to recognize the knowledge (i.e., conceptual) structure that underlies behavior. Program planners, public health nutritionists, and researchers are often too concerned with behavior change and may fail to recognize the system of knowledge that guides practices. Formative research has helped improve our understanding of the knowledge, beliefs, and meanings attached to behaviors, but pieces of information are extracted without understanding the relationships among them. It is in rebuilding this knowledge through appropriate methodologies that one begins to construct an emic framework. Otherwise, the information one extracts becomes part of an etic framework, built for the purpose of the practitioner to change behavior without truly understanding it.

Furthermore, there are potentially other risks when researchers commit to an accounting of psychosocial dimensions of maternal behavior without reconstructing the cultural knowledge. First, one implicitly assume that there is something wrong with maternal behavior and one miss an opportunity to use the system of knowledge already in place to improve upon existing practices. This fundamentally changes how researchers and practitioners engage with the community. Also, when interventions are designed based on this type of formative research, changing one or two key behaviors could inadvertently alter how the conceptual pieces fit together. How behavior-change promotion alters the underlying belief system and its unintended effects on untargeted beliefs is unknown because this has not yet been studied. A concrete example of unintended consequences was shared by women in our study. They noted how a few physicians were offering the advice that breast milk after 6 mo is like water, and women gave this as a reason why they started solid foods. Those

"health" messages as a way to promote a timely introduction of solid foods could potentially change the beliefs about breast milk after 6 mo, precipitating decisions to stop breastfeeding.

Researchers simply do not know how nutrition education messages are perceived or included in the maternal knowledge framework. For example, there is a recent push to promote animal-source foods and use home-fortification "sprinkles" in Mexico. The promotion of animal-source foods (e.g., beef) would be perceived as healthy food and thus be incorporated into the concept of "healthiness." This advice could have adverse nutritional consequences in an obesogenic environment (30) but also adverse ecological consequences (31) because one would have helped establish a behavior and a demand for meat very early on. Similarly, the promotion of home-fortification "sprinkles" could tag these as healthy foods without improving upon and helping establish good eating habits (i.e., eating a variety of fruits and vegetables) during the complementary feeding period.

The results from this study suggest that *probaditas* are important for food exposure but may not contribute significantly to calories and nutrients. Exposure to solid foods can occur well before 6 mo, but feeding sufficient amount of foods may not occur until after 9 mo in this community. This has implications for how one asks women to report when they started feeding solid foods.

I conducted 31 interviews but found that after about 20 interviews I was not obtaining new information from the women, and my analysis of the last 10 interviews did not substantially add new information to my categories; thus I reached theoretical saturation at 20 interviews (32). Women did not offer differing rationale or explanations for feeding their children, so the concepts and the cultural theme underlying child feeding were shared. The findings on underlying cultural theme corroborate the findings of Guerrero et al. (7) who found that women in Mexico City

chose infant feeding methods if they believed it provided good nutrition, health, and improved growth. They also noted these cultural beliefs to be shared to a high degree (7). Shared cultural knowledge, as I saw in this study, also indicates that child feeding is quite prescriptive, in the cultural sense. The cultural prescription is rooted in a logic that works to keep children well-nourished and healthy (33). My sample, however, is relatively homogenous in important socio-demographic characteristics. The conceptual structure would be different for women who have more education and whose cultural knowledge was derived from other social environments and experiences. Women mentioned to me that they had lived most of their lives in Xoxocotla or in nearby communities. I suspect that similar concepts exist in women living in similar social and ecological environments to the women in our study (28).

There are some limitations to the inferences that can be drawn from our sample. The types of foods and frequency of feeding vary by socio-demographic factors and so these specific results should not be extrapolated to other populations. Only 3 women in this study were not breastfeeding the time of data collection. Extended breastfeeding into the second year of life is very common among low-income Mexican women (34), but behaviors would be different among women who are not breastfeeding. My data is based on maternal reports and so I do not know to what extent women over-reported positive behaviors and underreported negative behaviors. For example, very few women talked about soda beverages, and yet the national data show that these beverages are given to preschool Mexican children (35). Nonetheless, the feeding patterns described here are similar to national-level data in that children in low-income households do not regularly consume non-human milk, legumes, and flesh foods (4). The observations were conducted 3-5 days after the interview and I did not observe women engage in behaviors different to those reported at the interview. Furthermore, extending data collection to the home improved the

trustworthiness of my data.

3.5 Conclusion

The results of this study show that women in this community have highly organized knowledge about child feeding. Elucidating the conceptual structure not only expands researchers' understanding of complementary feeding but also provides a new lens for viewing this phenomenon. That is, one is not simply dealing with a lack of nutrition knowledge, a set of barriers or facilitators or even a few key actors that may influence child feeding practices. Theirs is a system of knowledge based on the cultural norm of ensuring good health, nutrition, and growth. Viewed this way, one begins to understand why infants and young children in Mexico are fed diets that consist mostly of liquids and semi-liquids with few vegetables and legumes. One also begins to appreciate why certain behaviors have proved difficult to change (e.g., use of soups and broths). To acknowledge their conceptual structure implies that their knowledge needs to be part of the nutrition knowledge practitioners intend to deliver. If practitioners and policy makers want to succeed in promoting good complementary feeding practices, it is essential to conduct these types of studies to understand the knowledge framework in the communities they choose to work before attempting to change practices.

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APPENDIX 3

Interview Guide:

Name of the mother:_____

Age of the child: _____

A. Child and mother psychobehavioral factors.

1. Tell me a little bit about Maria [child's name]. What kind of child is she? [*Ascertain child's temperament*]

2. Tell me how it is to take care of her? [*Ascertain child behavior and parenting styles*]

Probe: does any one else help you take care of Maria

Probe: if so, do these caregivers live with you?

3. What have been your experiences with feeding her? [*Ascertain caregiver behavior*]

Probe: Are there times when it's easier to feed Maria. Are there moments when it is harder?

Probe: latching on, flat nipples, milk not coming in, not having enough milk

Probe: Was feeding Maria a different experience from that of your other children?

B. Current diet of child and responsive feeding

4. Describe for me the first time you fed Maria some solid food.

Probe: how old was she then?

Probe: what were those first foods?

Introduction of the following foods and types:

Fruits

Vegetables

Soups

Broths

Danonino, Yakult

When did you start with probaditas? Do you remember what those were?

When your child was born what you feed her?

Is she breastfeeding?

5. What does Maria eat? [*Ascertain the child's diet*]

How much do you serve her (sopa) and how much does she usually eat?

Where does she eat?

Do you feed her or does she eat by herself?

How often do you feed the following foods and what kind of these do you give her?

Fruits

Vegetables

Meat

Beans

Tortilla

Atole

Rice

Yogurt

yakult

6. Does Maria like some foods more than others? What are her favorite foods?

Proble: How do you know what she likes to eat? [*Ascertain caregiver behavior and child feeding cues*]

[If still breastfeeding only, then ask: when would your child be ready for solid foods]

C. Socio-cultural norms about child feeding

7. Have you received information about feeding your baby such as breastfeeding or feeding solid foods? [*Ascertain beliefs about breastfeeding*]

Probe: ask about Oportunidades, Liconsa, SEDESOL

8. If I were to hear a group of mothers talking about feeding a baby who is 1 year old, what kind of things would they be talking about? [*Ascertain cultural expectations, norms*]

D. Maternal Activities and Food selection:

I'd like to change the subject and talk about you.

10. First, can you tell me how many people live in the home? [*Ascertain social organization of the home*]

Probe: how old are the children?

11. Tell me a little bit about what you do during the day. [*Ascertain social organization of the home, lifestyle behaviors, time allotted for child care*]

Probe: type of chores and time spent doing them.

Probe: how often do you use walking as your mode of transportation?

Probe: if employed, what is the physical difficulty of the job?

-remember to ask her about her highest level of education.

12. What kind of foods do you prepare? [*Ascertain food available to the child, preparation techniques, food management*]

Probe: is anyone else involved in food preparation?

Probe: which foods do you consume every day?

Probe: what is the frequency with which you consume flesh foods, fish, ham, sausage, cecina, wieners, eggs, milk, cream/cheese, peanuts, beans, fruits (type), vegetables (which ones and how are they prepared).

Probe: do you consume raw vegetables?

What do you prepare to drink with the meals?

13. Can you tell me what you had to eat yesterday? *[Ascertain maternal diet using 24-hr recall]*. Use attached form.

14. Many people can't buy everything they want to eat because some foods are too expensive. Are there foods that you do not buy because they are expensive? [*Explore food security*]

Probe: if money was not a problem, is there anything you would like to eat more of?

Probe: is there something more you would give to Maria?

15. People's diets tend to change over time. We either eat more of certain types of foods and less of other types. Are there some foods you eat more or less of today than 10 years ago? [*Ascertain perceived significant changes in diet which could be related to life course (employment, marriage, worsening poverty)*]

16. Who purchases the food? Where do you buy your food? [*Ascertain physical and social environment*]

Probe: how often do you buy food at these places?

Probe: some mothers have mentioned that they buy foods at the tiendas. Do you buy foods at the tiendas?

Probe: what about prepared food sold in the markets or other local venues?

Probe: do you or your family members go to the nearby towns to buy food?

Probe: do you grow any of your own food?

17. What type of foods do you buy there? [*Ascertain food technology*]

Probe: Ask about the type of processed foods (e.g., cow's milk, formula, Danonino, Gerbers, sugar, cooking oil, tuna, mayonnaise, pastas, etc.)

Probe: what are the ways you use sugar in cooking?

Probe: how often do you buy carbonated beverages

Probe: how long does a kg of sugar and a liter of cooking oil last?

For each mother and child:

Weight

Height

Age

Body mass index

24-hr recall Form

Name of the mother:_____

Meal	Food item	Portion size	Comments (method of prep, brand name, etc.)

Observation Guide

Phenomena to specifically document while in the home:

1) Does any one feed the child or assist in feeding the child? [*Ascertain household social organization; caregiver behavior*]
2) Note the number of times the child eats (count the number of feeding episodes) as well as the types of food offered to or eaten by the child. Note if the child asks for food or other type of feeding cues [*Ascertain child's diet*].
3) Note utensils used during feeding and where the child is fed [*Ascertain caregiver behavior*]
4) What else does the mother do (e.g., chores, activities)? [*Ascertain household social organization*]

    -How does she fit child feeding into her activities? (e.g., does she stop, does she ask someone else to help, etc.) [*Ascertain caregiving practices*]

    -Does anyone else help her take care of the child?
5) Does the mother hold the child? (Note the position of mother and child, sideways, looking at each other. Is it a controlling or supportive hold?) Does she speak to the child? [*Ascertain caregiver behavior*]
6) When does the mother eat? (e.g., what foods were served and the amount) [*Ascertain maternal food selection*]

    -If she eats, does she offer these foods to the child?
7) How does she eat? (e.g., sitting, standing, in-front of the t.v.) [*Ascertain maternal and family eating behavior*].

    -Does the entire family sit down for a meal?

8) Are the mother and older siblings snacking? (note: what snacks and how much)

[*Ascertain mother and family eating behavior*]

-does the child snack also?

9) Provide a complete description of the physical environment of the home.

Chapter 4

"Mommy, what are you eating?" Examining the links between the maternal and child diet in the context of the household food environment.

Abstract

Maternal knowledge and behavior are important determinants of complementary feeding because mothers decide when to feed, what to feed, and how much to feed. Mothers also model eating behaviors. Beyond examining how mother and child interact in a feeding episode or how maternal food preferences can affect food selection or food exposures, the maternal-child food relationship has been given little systematic research. The objective of this chapter was to understand the maternal-child food relationship in the context of the household food environment. Dietary recall data, interview transcripts, and home-observation notes from an ethnographic study of a sample of mothers in Xoxocotla, Morelos (n=29) were used. Diets of mother-child pairs were compared for differences and similarities in food and meals, and transcripts and field notes were examined to ascertain what women were feeding the child and family and the factors that influenced these practices. There was substantial variability within and between mother-child pairs in the frequency of shared meals and foods. Shared behaviors were influenced by the age of the child, time of the day, the child's sleep patterns, maternal food preference, and presence of other family members. Mothers conceptualized child-appropriate foods as those without *chile*, soft, semi-solid, or liquid consistency, and healthy. Maternal diets reflected both her personal food choices and social roles in the home. The interrelationships among what the mother, child, and family eats are complex and should not be reduced to simple bidirectional relationships. These results have implications for how researchers

conceptualize the mother-child food relationship in complementary feeding practices (i.e., food selection and preparation, eating behaviors). These results highlight the need for holistic research approaches rather than examining a single dimension of maternal-child food relationship or the complementary diet.

4.1 Introduction

In complementary feeding research, an important focus has been to study foods fed to infants and young children. But what to feed, when to feed, and how much to feed are decided by the caregiver. Thus, caregiver knowledge and behavior are central to complementary feeding practices. One way researchers have examined caregiver behavior is through responsive feeding, which, broadly defined, is how caregiver and child interact during feeding (1). Implicit in the concept of responsive feeding is that the feeding interactions occur in social environment, so it is important to understand how the household milieu influences what is fed and how it is fed.

In addition to interacting with the child during feeding, mothers also model eating behaviors, and her food preferences can influence the types of foods to which her children are exposed (2, 3). In Mexico, for example, the fruits and vegetables consumed by the mother during pregnancy and lactation were often the infant's first foods (4). Others have found an association between maternal diet and complementary foods (5, 6), but the factors that link what the mother eats to the complementary diet remain mostly unexplored. It seems plausible that the maternal-child interactions around feeding, such as mother and child sharing foods and meals, may partly explain the composition of the complementary diet while providing a social platform for learning eating behaviors.

To advance our knowledge of complementary feeding practices, we need to examine more thoroughly the role of maternal knowledge, maternal behaviors, and the social environment in shaping those practices. In Chapter 3 of this dissertation, I presented evidence of the maternal knowledge that underlay complementary feeding practices. Given the high degree of shared cultural knowledge, I proposed that the family and the household environment could explain differences in practices. In this chapter, the objective is to analyze the mother-child dyad food relationship in the

context of the household food environment. This objective is embedded within the larger research aim of understanding the concepts and practices of feeding infants and young children in Xoxocotla, Morelos.

In this chapter, I take a particular ethnographic approach, which is to analyze the similarities and differences in social behavior, namely what mothers and young children were eating. With this approach, I move beyond describing what foods are fed to the child to understanding the mother-child food relationship and reconstructing the various social processes that give rise to the complementary feeding practices observed in this community.

4.2 Methods

My participants lived in a small town, Xoxocotla, located 40 km south of Cuernavaca in the state of Morelos. A detailed description of the study setting, sampling strategy, and field methods are provided in Chapter 3 of this dissertation. I provide here only the relevant information for understanding data analysis and interpretation of results.

4.2.1. Maternal knowledge of child feeding practices

Ethnography is well suited to examine social practices. Meaning behind the social practices can be extracted by analyzing language (7) and activities in the daily life (8). Looking for differences and similarities in social behavior is necessary to construct meaning, so comparison is central to ethnography.

I completed an ethnographic study to understand child feeding practices in Xoxocotla, Morelos. Using convenience sampling, I recruited 31 mother-child pairs with children ages 6-18 mo because at this age children in this community spend most of the day with their mothers and are likely to depend on the mother for meeting all their nutrition needs. Semi-structured interviews were completed for each participant and home observations were completed for 27 participants. Home observations were

scheduled at the woman's convenience between 8 am and 2 pm.

It became evident through interviews and observations that knowledge of feeding children was shared among the participants. That is, despite differences in maternal weight, household economic constraints, and household composition, their descriptions and concepts of child feeding were quite similar. The data analysis confirmed this and revealed a highly shared and complex knowledge framework for feeding infants and young children (Chapter 3 of this dissertation). The maternal knowledge framework had 8 factors: (1) *probaditas* (the idea of introducing small tastes of foods), (2) preparing separate foods for infants, (3) readiness to eat solid foods, (4) appropriate consistency, (5) variety, (6) child likes and dislikes, (7) money and food costs, and (8) healthiness of foods (positive and negative foods).

To contextualize child feeding, I inquired about the physical environment (built and ecological environment), social environment (cities, towns), social organization, technology, culture and ideas (9). The data supported a close relationship between the maternal knowledge and the social organization of the home even though I did not purposefully study the interrelationships among these factors. This was not an unexpected finding given that the household is a proximal determinant of child feeding practices. To understand the social organization of the home, I obtained information about food purchases and preparation, the mother's eating patterns (via a 24-h dietary recall), maternal employment and maternal activities in the home, and the presence of other siblings. Included here were questions about having enough money to purchase foods and use of government assistance programs.

In this chapter, I analyze what the mother and child were eating and the types of meals prepared for the family. It is through examining the shared and non-shared dimension of these three phenomena that one can begin to understand the maternal-child food relationship (i.e., sharing foods and interactions around food) and the

factors shape it.

4.2.2 General analysis strategy

The questions that guided my analysis were: what were some of the differences between the maternal diet and the child's diet (i.e., number of meals, timing of meals, and types of foods)? What were some shared behaviors (i.e., shared meals, eating between meals, consuming the same foods)? How were child foods conceptualized? What factors influenced maternal practices for preparing meals for the young child? What were the considerations for food purchasing and preparation for the family?

I read the transcripts and field notes to obtain the major themes about feeding children (first pass). The themes that emerged from this first pass and are relevant to this chapter were (a) child foods and food frequency, (b) food preferences, (c) family and adult foods, (d) and money. Then in more detail, I examined the maternal and child recalls and coded responses for foods, beverages, and meals using Atlas Ti (v 5.2, GmbH, Berlin). I read the transcripts specifically for how mothers conceptualize the foods for infants and young children. I also considered the type of foods used to prepare the family meals as well as other actors could influence the relationship between the maternal diet and the child diet from the transcripts and the observations. To distinguish the foods fed to the young child from the foods fed to adults I used the term "child-appropriate" in this chapter.

I examined the 24-h recall of mother and child looking for similarities and differences at meals and between meals among women with children ≥ 9 mo (n=22). The practices that were of interest were mother and child eating between meals, eating together, eating similar foods, or eating different foods (see definitions below). I counted the occurrences where the mother reported these behaviors, and some women reported more than one behavior in the recall period. Excluded from this analysis were women with children between 6 and 8 mo (n=7) because most infants were first

starting solid foods, so breast milk and formula feeding were the dominant food. The analysis of dietary data and field notes included 10 overweight (BMI 25-29.9 kg/m^2) and 9 obese (BMI 30- kg/m^2) women and 3 normal weight women (BMI 18-24.9 kg/m^2). My home observations proved particularly valuable to understand what factors could affect meal structure and meal times.

4.2.3 Definitions

Diets. A diet was defined as the foods and beverages consumed in a single day.

Meals and eating between meals. I used the emic definitions of meals. In this community the three main meals were *almuerzo* (savory breakfast), *comida* (the main meal, a late lunch), and *cena* (dinner). In the sample, *almuerzo* was served between 9 am and 12:30 pm, *comida* between 1:30 pm and 5 pm, and *cena* between 7:30 pm and 10 pm. Some participants discussed *desayuno* (breakfast; *atole* and perhaps sweet bread), but this was not common practice.

Meals were highly structured eating events where two or more foods were prepared and manipulated using heat (i.e., cooking or reheating) and participants sat at a table. Thus I defined eating between meals as consuming one or two food items that did not require preparation or heat (e.g., fruit or crackers, or juice and crackers) and which were consumed between these structured eating events. Participants did not have a word to describe “eating between meals”.

Although breastfeeding and bottle feeding (cow’s milk or formula) constitute meals for infants and young children, I did not consider these when counting shared meals because the mother cannot partake of these foods. Moreover, the bottle feeding events occurred shortly before or as the child was put down to nap.

Shared meals. I examined shared meals as they were an opportunity for mother and child to eat the same foods. Also, meals are important in learning the social behaviors for eating (10). In most homes I visited, I did not observe the mother

eating alone, and who was present at the meal seemed to be an important factor for deciding what foods to prepare.

I defined shared meals as meals when mother and child ate together at a specific time. Because most mothers were active participants in the child's meal (i.e., they fed or help feed the child), I considered shared meals those that occurred within 30 min of each other. I coded whether or not the mother and child had shared at least one meal.

Shared foods. I counted the number of times a mother ate the same food item as her child at a given meal, even if the meal was not shared. For example, if the mother had eggs, beans, and *salsa* at *almuerzo* and the child received eggs and beans for *almuerzo* but 1-2 h before, I coded that the mother and child shared two food items.

Same food group, different consistency. I looked for instances when the mother prepared chicken or beans for the family and the child received the broth in which the foods were cooked.

Child-appropriate alternative. These were occasions when the mother consumed a completely different meal than the child (i.e., the child's meal was prepared especially for him).

4.3. Results

I interviewed 31 women but eliminated 2 interviews because one child was premature, and these children have distinct feeding patterns compared to term infants, and the other interview was incoherent. The main social characteristics of women that participated in our study are presented in Table 4.1.

Table 4.1. Characteristics of the 29 women included in the analysis.

Characteristic		Remarks
Maternal age, *y*	25.9 ± 5.3[1] (18, 37)	
Child age, *mo*	12.4 ± 4.1 (5, 18)	
Children ≥ 1 y	68%	
Body Mass Index, *kg/m²*	28.4 ± 5.0 (17, 37)	
Women with BMI ≥ 30	41%	
Education, *y*	8 ± 2.2 (6, 12)	
Employment, *n*	7	Selling food: tortillas, vegetables or fruit
Government programs, *n*	8	4 received *Oportunidades* 4 received *Liconsa*
Lived with others, *n*	19	In-laws or parents
Married, *n*	26	
Parity, *n*	2.2 ± 1.04 (1, 5)	
Breastfeeding, *yes, n*	26	

[1]Mean and standard deviation; range in parentheses.

The final sample consisted of 7 normal-weight women (BMI range: 17-23 kg/m^2), 12 overweight women (BMI range: 25-29 kg/m^2), and 12 obese women (BMI range: 30-37 kg/m^2). Most mothers did not have any formal employment. Of the two mothers who worked, only 1 worked 6 days a week and the other worked part-time. In this community, it is common for women who marry to move into their in-laws' house, and 65% of the sample reported living in the same house with her in-laws or her parents. Three women had stopped breastfeeding; all other women were practicing varying degrees of breastfeeding, from on-demand full breastfeeding to token breastfeeding (breastfeeding at night, at nap times or when the baby was fussy).

4.3.1 Shared dimensions between the maternal and child diet

Analysis of maternal and child 24-h recall data revealed that mothers ate foods prepared for the adults and for the young child throughout the day (Table 4.2). Most mothers, with the exception of six women, shared at least one meal with their child. Of

the 17 shared meals between mother-child pairs, 8 mothers reported drinking carbonated beverages with that meal. Mother and child *almuerzo* and *comida* were similar in foods categories and food consistency compared to *cena*, when the father was more likely to be home. In fact, at *cena*, 14 (48%) mothers reported a meal consisting of adult foods (e.g., meat or eggs in salsa), while 8 (27%) women ate a meal consisting of child-appropriate food (e.g., soup, milk, *atole*). Seven (24%) women did not report eating *cena* that day. Some women reported eating from their husband's plate. Unless the adult *cena* was child appropriate (e.g., soup) or could be made child appropriate (e.g., eggs prepared without salsa), the children were prepared a suitable alternative.

Mother and child generally did not snack together and meal times were not always structured around maternal eating times (Table 4.2). All mothers reported sitting their children at the table for meals and I observed this at the home also. There was good agreement between the observations and recall despite that the observation occurred in the early part of the day (~8:30 am – 2 pm). The observations provided rich explanations for the behaviors captured in the recall given that I did not ask women to explain their meal schedules.

Sometimes shared meals did not occur in the early part of the morning (before ~ 11 am) because the mother was busy doing her chores or the child was sleeping. In some cases, mothers told me they had eaten early with their husbands or with the older children before sending them off to school. In other cases, I observed the mother eating later in the morning after completing her chores. Four women did not eat a meal during the observation period nor reported having *almuerzo*. Two of these women ate the child's left-over.

Another reason for not sharing meals was that mothers practiced on-demand feeding. That is, a mother gave her child food (including breast milk and non-human

milk) when she interpreted crying or fussiness as hunger or when the child asked for food. As one mother noted, "when he is hungry, he will ask for food". Sleep patterns also determined eating patterns because mothers were more likely to bottle feed or breastfeed if the child wanted to sleep.

Child-appropriate alternatives were observed to occur less frequently than in the maternal reports. This supports the idea that if a separate meal was prepared for the child, it was likely to occur when the father was home.

It was common for children to eat between meals. Fruit was the most frequent item offered followed by Danonino (fortified cheese product), juice, and crackers. Very few mothers ate these foods with their child. Non-fried, packaged snack foods were offered to a few young children.

Throughout my observations, child-appropriate alternatives were usually more nutritious or prestigious (e.g., egg, chicken, fish, and sausage) compared to what the mother ate. This concurs with their discussions of how adults eat less healthy so the children can have better diets.

Table 4.2. Shared meals and foods between mother and child in 24-h dietary recall and home observation.[1]

Behaviors	Dietary recall	Observation	Definition
Shared meal	17	6	Mother and child eat at least 1 meal at the same time
Ate in between meals	n=6	n=3	Mother and child 'snacked' on the same food item
Fruit	5	3	
Cracker	1		
Shared foods	n=18	n=15	Mother and child consumed the same type of food at a given meal even though they did not consume the meal at the same time
Atole	2	1	
Eggs	4	4	
Soups	2	4	
Broths	2	1	
Chicken	2	1	
Tortilla-based meals[a]	3	1	
Lentils/Beans	1	1	
Fish	1		
Rice	1	1	
Chicharron[b]		1	
Ate similar food group but modified consistency	n=3	n=1	Mother prepared adult-appropriate food but used a method of preparation that ensured a child-appropriate meal
Chicken/broth	1	1	
Bean/broth	2		
Child-appropriate alternative	n=25	n=12	The child receives a suitable alternative when the mother consumes adult-appropriate foods.
Eggs	3	1	
Fruit	2		
Milk	2		
Soup	7	1	
Broth	4	1	
Taco/tortilla	1	1	
Lentils/beans	5	2	
Atole	1	1	
Potato		1	
Chicken		1	
Rice		1	
Fish	1	1	
Sausage		1	

[1] Based on analysis of 25 mother-child pairs (child ≥ 9 mo); home observations (~8:30am -2:00pm)
[a] Tortilla-based meals: *picadas, sopes and gorditas,* where tortilla is the main ingredient and garnished with heavy cream, cheese, and tomato sauce. [b] Pork rinds.

Table 4.3. 24-h recall data showing the degree of shared foods and shared meals in two mother-child pairs.

Child (boy, 14 mo)	Mother
9 am: plums	9 am: plums
10:30 am, *almuerzo*: ¼ *gordita*, tomato sauce	11 am, *almuerzo*: *gordita* with sausage
1 pm: sweet bread, small piece	1 pm, *comida*: fish broth with piece of fish, tortilla, and carbonated beverage
3 pm, *comida*: fish taco	-
7 pm: melon, small piece	8 pm, *cena*: pork steak, tortillas, a melon slice, carbonated beverage
Child (boy, 17 mo)	**Mother**
desayuno: pudding made with milk	-
12 pm, *almuerzo*: rice with chicken wing	11 am, *almuerzo*: rice with tortillas and carbonated beverage
2:30 pm, *comida*: bean broth	5 pm, *comida*: salsa with tortillas
8 pm, *cena*: bean broth, banana, pudding	-

The similarities and differences in meals between mother and child can be appreciated in the following examples (Table 4.3). In the first example, there is overlap in types of foods, food groups, timing of meals; whereas in the second example, only rice eaten at *almuerzo* is the same between mother and child and the mother has prepared a suitable alternative to the child for the other two meals.

Sharing of food occurred mostly in the context of sharing meals. When mother-child pairs shared meals, the mother tended to consume the child-appropriate alternatives, so flesh foods were consumed less frequently by the child. The sharing of food and sharing of meals also reflects how women conceptualize child-appropriate foods both as specific food items and in the practice of preparing foods separately. It is through these dimensions that maternal knowledge and the social process of child feeding becomes evident.

4.3.2 Conceptualizing child-appropriate foods

Mothers discussed child foods in relation to family foods and foods consumed by adults. Adult foods were prepared in *salsa*[20] that had *chile*[21]. When mothers prepared foods in *salsa* (e.g., eggs, chicken or tortilla with *salsa*), they stated to have "prepare food separately" for the child. "Prepare food separately" was part of their knowledge framework on how to feed children and the concept encompassed a nuanced and dynamic relation among the child's diet, maternal diet and family foods.

Women revealed the criteria necessary to classify foods as "child-appropriate". The first and most important criteria was that the food could not have *chile*; foods needed to meet specific consistency requirements (liquids, semi-solid, soft); and foods should be healthy. Foods valued for their healthy attributes were fruits, vegetables, chicken, Danonino, and Yakult (probiotic beverage). Foods avoided or provided less frequently were 'junk foods', carbonated beverages including Coca Cola, oils, bean, and pork meat. Food variety, the child's preferences, and the presence of other young children ≤ 5 y old were other salient factors for preparing child-appropriate meals.

> What happens is that I prepare food separately. For the kids I make a broth and for example when I make rice soup it is for everyone. When I make *requesón*[22] I put some aside [for them] and for us it's with *chile*. (Elodia, son, 15 mo)

> We make double food because I have to prepare nutritious food for my other children too. We [adults] eat just salsa…but I make them pasta soup, bean broth, *atole*, oatmeal with milk. (Carol, daughter, 14 mo)

> I give him one day yes, one day no because I vary it. One day it's rice, another

[20] *Salsa* is prepared by placing tomatoes, onions, and hot peppers in a blender to achieve a thick soup-like consistency. Salsa is an accompaniment for grains (i.e., tortillas), meats, or eggs. Foods can be cooked in salsa or the salsa can be prepared separate from the food and then an individual can serve themselves as much salsa as they please.

[21] *chile* are fruit of the *Capsicum* plant and used as a spice. In Morelos, the most common *chiles* are jalapeños and *chile* de *arbol.*

[22] Requesón is a fresh cheese made by cooking whey protein. It is lumpy and resembles ricotta cheese.

> day potatoes, another day beans, one other day broths. The soups are made with pasta. I vary it because each soup has a different taste. Sometimes I give elbows, noodle, sometimes letters. (Nadia, son, 17 mo)
> I haven't given him [egg] because he doesn't like it. (Marta, son, 16 mo)

Mothers also considered the time required to prepare separate meals against their other daily responsibilities.

> I haven't had much time to have take care of my daughter because my other children take up too much time. I have to take them to school, they come back from school, give them something to eat, supervise their homework. They take more time than this one [baby]….yesterday I got up early, went to the market and bought some chicken and prepared chicken broth, but I only gave her the broth not the meat. (Marilu, daughter, 8 mo)

> Well you can say that it's mostly soups for my kids. It's based on how much time I have. Like I say to my husband, because he says that we only eat soups, I find it the easiest food to prepare. It is ready in one hour…sometimes I make salsa separate for us [adults]. (Gina, son, 18 mo)

Child-appropriate foods could be consumed by adults as discussed by Gina in the quote above. Adult foods that fit the child-appropriate criteria (i.e., no chile, consistency, and healthy) could also be eaten by the child, but this was more likely to happen when the child was older.

> He eats almost everything. I give him everything. There are days he eats and days he doesn't eat, but I give him everything I prepare. Rice, sometimes a hard-boiled egg or I make *nopales*[23], and he eats those. (Gina, son, 18 mo)

> The food I give my child I make for everyone. (Rocio, son, 17 mo)

4.3.3 Household food purchases and child foods

The foods purchased for the household that were commonly consumed by the young child included tortilla, rice, beans, fruits, vegetables, chicken, fish, eggs, cheese and heavy cream. Items purchased for the household but not consumed often by the

[23] *Nopales* are the pads of the prickly pear cactus whose thorns have been removed. The pads are sliced and then cooked.

child (cited ≤5 times by mothers) were *nopales*[24], beef, deli-style ham, *cecina*[25], and wieners, lentils, *bolillo*[26] and potatoes. Mothers were more likely to serve infants bean broth without the bean and older children bean broth with beans and tortilla, but whether children were given beans varied because some mothers believed that the bean could cause indigestion. Only two women prepared lentils for their child.

Specialty items such as Danonino and Yakult were purchased for the young children. Pudding (similar to custard style pudding) were mostly prepared at home but could be purchased from street vendors. The beverages given to the child were water, cow's milk (powdered or fluid), *agua fresca*[27], fruit juices (100% juice and fruit flavored drinks), and *atole.* Fruit-flavored sodas and milkshakes were cited infrequently (<5 times). *Agua fresca* and sometimes *atole* and milkshakes were prepared at home.

Foods purchased for the family but not consumed by the children were sausage and pork. Pork was considered a 'heavy' food for young children and only 2 women fed pork to their child. Ham, although a pork product, was consumed more often than pork meat. Coca Cola was the only beverage that women reported not giving their child, but I observed one mother giving her 18 mo-old child Coca Cola.

Young children received tortilla, thin wheat noodle[28], rice, fruits, vegetables, chicken, fish, eggs, and dairy, as frequently if not more frequently than the rest of the family. Beans, although a dietary staple, were the exception as noted. How often

[24] *Nopales* are the pads of the prickly pear cactus whose thorns have been removed. The pads are usually sliced and then cooked.

[25] *Cecina* is a thinly sliced beef that is marinated and sun-dried.

[26] *Bolillo* is similar to a baguette.

[27] *Agua fresca* is freshly squeezed fruit juice (e.g., lime and oranges) or pulp which is obtained by using a blender (e.g., melon, strawberries, and pineapple), water, and sugar to taste.

[28] Thin noodles were purchased from the market or tiendas to make soups. Soups and broths were staple foods for these children.

(daily, weekly, or monthly) these foods were provided to the child reflected how often the mother purchased them and the age of the child. For infants, fruits, broths, and soups were likely to be offered daily. For young children ≥1 y, tortilla, broths, and soups were provided daily. Fruits, vegetables, chicken, eggs, and diary were provided weekly. Fruits were provided more frequently than vegetables, but there was a wide range in frequency (from everyday to 2-3 times per week), which reflected preferences and economics. Fish and rice were provided anywhere from once a month to once a week.

> I try to give her, for example, if I eat melon, I give her, when there is watermelon, well watermelon, mango, I give her plum too. What I find in the market is what I take home and I give her taste of that food (*probaditas*). (Graciela, daughter, 12 mo)

> Well right now I feed her taco with cheese or prepare her bits of tortilla with beans and cheese. Sometimes I buy chicken and prepare a soup or sometimes I buy vegetables and prepare it with chicken. Yes, well basically what we eat I give her except that I don't give her pork. (Mary, daughter, 16 mo)

Household food availability: finances and preferences

Food shopping was done mostly by the mother and money was used to purchase foods from the local market, *cremerias*[29], and *tiendas*. Some women purchased foods from nearby towns. One participant reported growing papaya, four participants ate fruit from a tree on their property (e.g., orange, mango), and three participants raised livestock for household consumption (chicken for eggs; hog). I observed mango, lime, tamarind or other fruit trees in some of the homes. Women purchased white corn from the local veterinary store to prepare home-made *tortillas*. Food gifts, via their extended family networks, were a way to acquire food in kind. In the observations, I noted how some food was shared between families in the same

[29] *Cremerias* and *tiendas* are stores. *Cremerias* are a bit larger than *tiendas*, and in addition to selling most of the items found in a *tienda*, *cremerias* carry mostly perishable food items such as cold cuts, milk and other dairy products as well as bottled juice and *bolillos*.

household. But when I asked women about this practice, they said that this happened only on occasion and that each family tended to prepare their own food.

Financial constraints influenced how often fruits, vegetables, meats, eggs, and dairy were purchased for the household, and from these items, women selected the appropriate foods for their young child. Table 4.3 provides a summary of the foods given to the young child and the strategies used by the mothers to compensate for financial constraints. Women described purchasing carbonated beverages when the fruits required for *agua frescas* were expensive.

Food preferences informed the type of foods purchased for the household. As Guadalupe noted about purchasing lettuce and radishes for the family, "it also depends how often they ask. Sometimes we eat them once a week". In contrast to fruits or milk, vegetables were noted as least preferred. If the children did not like vegetables, then the mother was less likely to prepare them. In cases where the father did not like vegetables, the mother had the option to prepare them without necessarily serving them to the father. Preferences were accentuated if money was a concern.

> I buy potatoes and I fry them and serve them with ketchup, like French fries. My [older] daughter doesn't like other vegetables [squash, carrots] and I give them what they eat. (Gina, son, 18 mo)
>
> I don't prepare vegetables for my husband because he doesn't like them and that's why I only prepare vegetables for the children and me (Tulia, son, 9 mo)
>
> With my husband I make more chicken, more meat because he doesn't like vegetables. Now I make them for my son and I eat the vegetables with him. Sometimes I prepare a lot so I can eat with him. (Marta, son, 16 mo)
>
> I tell you they don't eat vegetables. My son and daughter don't like them. It's only the baby that eats the vegetables… we adults eat few vegetables because they don't like vegetables and so I don't prepare them. I don't have enough money to make two separate meals. (Guadalupe, son, 14 mo)
>
> I don't prepare vegetables…I don't like them. (Ari, daughter, 12 mo)

Table 4.4. Food categories fed to children 6-18 mo and the strategies used by their mothers to compensate for economic constraints.

Food categories	Type of foods	Strategies to compensate for economic constraints
Fruits[1]	Banana, oranges, mango, watermelon, melon, peach, plum, papaya	Purchased what was in season and the cheapest item
	apple, pear, grapes	Purchased individually
Vegetables	Chayote squash, zucchini squash, potato, carrot, green beans, broccoli, cauliflower, peas, corn, and cabbage.	Purchased infrequently for the household
	Spinach and other greens [2]	Purchased only for the young child (spinach)
Meats[3]	Chicken	Purchased chicken parts and purchased cheaper parts (e.g., saddle, foot, wing)
	Fish	Food gift
	Beef	Purchased infrequently or not at all
Dairy	Cow's milk (powdered, fluid), yogurt, Danonino	Provided only when they were available
	Puddings [4]	Prepared with water
Eggs	-	Prepared more frequently

[1] Apples and pears are expensive and were often cited as the first foods for infants. They were purchased individually rather than by the kilogram.
[2] Only 3 women mentioned spinach or *huazontle*, a native green.
[3] Chicken pieces were purchased to prepare broths and soups. Chicken meat could be fed to the child if the mother considered it safe and appropriate. Beef was not given frequently to children and was purchased at monthly intervals or not at all for the family.
[4] Puddings were often made at home from store bought packages and usually prepared with milk. They could be prepared with water if milk was unavailable.

4.3.4 Maternal diet and child diet: conceptualizing food spaces

One can conceptualize the dimensions of the maternal and child diet as each having their "food spaces". These food spaces represent foods that mother and child

chose to eat from those available in the home. The child ate foods that were child-appropriate (as conceptualized by the mother) and those that he preferred. What the mother ate was a function of her preferences, who was present at the meal, and the time constraints. The larger household diet consisted of foods purchased for the family. Money and the preferences of the family members influenced the household diet. The maternal and child diet were embedded in the household diet (Figure 1).

Maternal and child diets overlap diachronically. That is, the degree of overlap varies over the complementary feeding period and within a given day. For example, there is less overlap in late infancy and greater overlap as the child grows older. Throughout the day, the overlap may be greater for meals occurring in before *cena*. The overlap also varies within the meal (i.e., types of foods and beverages) and with the presence of the father and other young children.

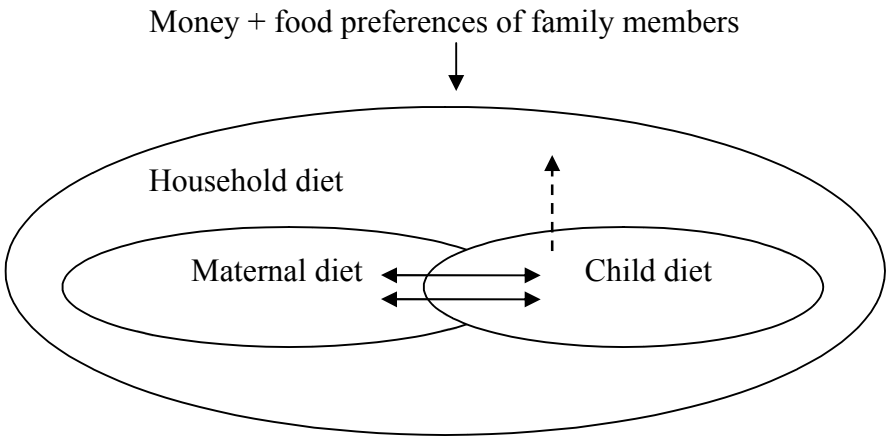

Figure 4.1. Mother-child diet and their links. Dashed arrow: child foods and beverages can be consumed by the rest of the household. Double solid arrows: represents the dynamics and degree of overlap.

4.4 Discussion

The shared and non-shared dimensions of the maternal and child diet were examined to understand the mother-child food relationship and elucidate the social processes that give rise to the complementary feeding practices as well as the potential social spaces where mothers could model eating behaviors. The links between the maternal diet and the child's diet were complex and not simply reducible to mothers' capacity to influence food exposures as had been reported by others (2, 4, 11, 12). I specifically looked at shared foods and shared meals. The degree to which foods and meals were shared (i.e., overlap) was a function of the time of day, food preferences, presence of other family members, and time constraints. The overlap between the two diets was greater as the child grew older. Mothers had specific ideas about what foods were child-appropriate, which guided decisions about shared meals and foods. The versatility of the maternal diet to move in and out of the child's food space is a novel finding that has implications for how researchers conceptualize mother-child relationships in regard to complementary feeding practices. Moreover, the idea of food spaces, a unique contribution to complementary feeding research, captured the household dynamics that influenced the child's diet.

Shared foods and shared meals are two ways one could conceptualize the maternal-child food relationship. Sharing foods is important because it is a mechanism through which a mother can expose the child to family foods (i.e., food exposures) during the complementary period (13). The data in this study revealed that if mother and child were sharing foods, mothers consumed the child-appropriate alternative most of the time, that is, foods which the mother considered appropriate to feed her child. Most of the child-appropriate alternatives were foods without *chile*, deemed healthy, and were of the appropriate consistency [i.e., liquid (e.g., broths) semi-liquid (e.g., soups) soft foods (e.g., eggs)]. Even when there was an opportunity

for the child to consume foods prepared for the family (e.g., chicken or bean), the mother often chose to prepare something separately for the child. In other words, the child was not always exposed to the adult or family meals. The implication of this finding is that if nutrient-dense, family meals are available, mothers are not sharing them with the youngest children for various reasons, so educating the mothers to give chicken or beans more often might not have the desired impact.

Sharing meals is also important because meals provide an opportunity for socialization of eating habits (14). Although mother and child frequently shared at least one daily meal, in the dietary recall there were only 11 occurrences when they shared two or more meals. Moreover, there was substantial variability in the degree of shared meals between mother-child pairs which could be attributed to the time of day, the presence of the father, and maternal activities. Maternal activities and the extent of her child care obligations are important in child feeding decisions (15). In the present study, there was evidence that the scope of child care and domestic chores influenced to what extent young children and adults shared meals. Also fewer meals were shared because mothers respected and gave priority to the child's eating and sleeping schedule. Other factors for sharing meals include cost of food and fuel (e.g., gas or fire wood). These data show these factors should be considered when studying the role of the mother in modeling eating behavior in communities like this one.

Researchers define two types of complementary foods: transition foods and family foods (16). Transition foods are those foods that have undergone some modification so that they are appropriate for a child. The modifications can be in texture or taste. In this present study, with few exception, most foods purchased for family consumption were cooked differently (i.e., stewing, boiling) for the young child than for adults. In an evolutionary sense, the practice of using foods consumed by adults and converting them to a child-appropriate form has been occurring for

centuries among agricultural societies (17). Among modern societies, transition foods are often home-made pap or manufactured products, infant cereal, crackers, formula, and jar baby foods. In my study, mothers had their concept of transition foods, and these were different from the family foods. Their concepts of transition foods, or child-appropriate foods, were healthy foods of a liquid, semi-liquid, or soft consistency, and did not have *chile*. Included in their ideas of transition foods was the practice of preparing foods separately for the child, which revealed the underlying social processes of the complementary diet. The idea of family foods or what is in the "family pot" is complex because mothers prepare meals based on who will be eating those meals, so the family pot may be the child-appropriate alternatives when she is preparing food many young children or adult-appropriate if the father or older children will be eating. The foods that were not normally fed to young children but were consumed by the family were beans, pork, and *chile*.

I did not obtain an approximate age when child-appropriate foods would cease to be prepared. I surmise from our conversations and observations that consumption of child-appropriate foods may occur less frequently after 24 mo as the child is transitioned to the "family-adult" diet. This is culturally specific. For instance in Zimbabwe, by about 12 mo, the child is already receiving the adult staple food, *sadza* (thick maize porridge) (18).

Research linking maternal diet to the complementary diet is sparse. In Mexico, Menella et al. (4) showed that the fruit and vegetables preferred in pregnancy and lactation were likely to be the infant's first foods. In the U.K., foods consumed by the mother were often part of the infant's diet (6). Similar patterns were noted among maternal diets and complementary foods in African American mother-child pairs (5). These quantitative studies provide evidence of a relationship, but they do not elucidate how the diet of the mother is linked to the diet of her child. Data from behavioral

studies of preschoolers suggests that maternal food preferences may be an important link (2). I found this to be the case for shared vegetable consumption, and my findings corroborate that preference for vegetables influences consumption (2, 19, 20).
A mother's personal preferences, such as liking milk, fruits, and vegetables, may also drive food purchases, even though the mother may actually not actually consume these foods in cases of severe money shortage. Also, maternal preferences for adult foods may explain why the mothers consumed the child-appropriate alternative less frequently than the adult-appropriate foods, although I did not ask mothers to explain their food choices. The data also reveal that mothers considered the preferences of others when making decisions about food purchases and preparation.

My results provide insight on the social role of mothers in regards to food. This has implications for how researchers conceptualize the mother-child food relationship. The versatility of the mother to move in and out of the child's food space reflects the dual role of mother and wife. Social roles have been cited as an important factor in complementary feeding in Zimbabwe (18). In Mexican migrants in the U.S. preparing elaborate meals shows commitment and love (21). That women and her husband eat from the same plate may reflect intimacy between the couple. The husband's food preferences may be accentuated when the couple eats from the same plate, which may distance the mother from the child's food space. Because of the social construction of the maternal diet, the maternal diet may be a better proxy for household food availability than for personal eating behaviors (e.g., preference for vegetables, drinks milk), particularly in this low-income context.

Household finances play a predominant role in food purchasing decisions and food preparation, which is expected. In households where money was a serious concern, the strategy was to feed the child the healthy foods instead of the adults. A similar strategy has been reported in food-insecure households in the U.S. (22). In the

present study it is difficult to disentangle the causal direction between finances and food preferences. The data certainly revealed that money affects the frequency of food purchases. What is not clear is whether food preferences work within the financial considerations to influence foods purchases or whether food preferences are first considered followed by what can be afforded. For example, do mothers buy fruits because they are preferred over vegetables and then buy the banana the child likes? Because money is provided to low-income families as subsidy for food in Mexico, understanding the causality is important. If preferences are driving purchases, then other strategies along with adequate income are needed to improve the use and preference for nutrient-dense foods.

There are some limitations to the inferences that can be drawn from the data. An important limitation is the amount of time I spent with participants. I interviewed mothers only once, and home observations were restricted to 6 h to improve participation. To compensate for the short contact period, I transcribed the interviews before each observation and used the home observations to verify statements and ask follow-up questions. But more time in the home, especially when the father was there, would have provided more insight. It is not known to what extent my presence in the home changed women's behavior. Also, the data are based on maternal reports, and so it is possible that mothers over-reported positive behaviors and underreported negative behaviors. The feeding patterns described here, however, are similar to national-level data in that children in low-income households do not regularly consume non-human milk, legumes, and flesh foods (23). The observations were conducted 3-5 days after the interview, and I did not observe women engage in behaviors different to those reported at the interview. Although these results should not be extrapolated to other cultural groups, these data may provide valuable insights to researchers working with less acculturated Mexican-American population in the U.S. I found similarities in

knowledge (healthiness) and practices (foods consumed at meals) with data from Mexican-American women (20) and Hispanic children in the U.S (24).

4.5 Conclusion

In summary, I examined the maternal-child food relationship by analyzing the shared and non-shared dimensions of the maternal and child diet as well as what mothers prepared for family meals. Various factors including maternal food preferences, time of the day, presence of other family members, and daily activities influenced the degree of overlap between the maternal and child diets. Complementary foods were selected from the foods available in the household, and money and food preferences of the family were important considerations for what could be purchased. A novel contribution to complementary feeding research is the idea of food spaces as a concept to examine the social processes that construct the maternal and the child food relationship. Food spaces are important because they could uncover how maternal knowledge and behavior could influence a child's food exposures and eating behaviors. The interrelationships among complementary foods, maternal diets, and household foods are complex, and should not be reduced to simple bidirectional relationships. Thorough consideration of the dynamics in the home in different cultural contexts is needed to improve complementary feeding practices. Because our community was semi-urban, it would be important to replicate this study among urban and rural households where the food environment external to the home is likely to be different.

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Chapter 5

Conclusions

The purpose of the dissertation was to study infant and young child feeding (IYCF) in Mexico in relation to maternal characteristics. I took two distinct methodological approaches. Using epidemiology, I examined maternal fatness not only because of its direct physiological impact on breastfeeding but also because a mother's weight is a proxy for a larger food environment inasmuch as weight is a consequence of dietary intake. Then using ethnography, I pursued the mother-child link in two other ways: (a) examining the maternal knowledge that guided complementary feeding practices; (b) examining the diet of the mother and child for shared food spaces and how the diets are related to the household food environment.

In this concluding chapter I summarize the findings of the previous chapters and discuss the implications of my findings in the broader context of improving IYCF practices. Also included here is a discussion of the broader food environment in Mexico and its impact on the dietary patterns of mothers and young children.

5.1 Summary of findings

In Chapter 2, I examined the association of maternal fatness with breastfeeding duration, dietary diversity, and child feeding practices as captured by an index. I used secondary data of mother-child pairs that were collected between 1997 and 2003. I proposed that maternal fatness would be negatively associated with breastfeeding duration and positively associated with dietary diversity and negatively associated child feeding practices. In fact, maternal fatness was not associated with any of the three outcomes.

The various analytical approaches in this chapter revealed that maternal fatness was not associated with child feeding practices, and that child feeding practices were

relatively homogenous. There was an interaction between maternal weight and child age, but the interaction was not of public health significance. There are two possible explanations for our findings, the wealth explanation and the cultural explanation. Participants were sampled from a low-income community. Regardless of maternal weight, infant formula was not an option for most women in this study because infant formula was too expensive. Wealth also influenced dietary diversity (DD) and child feeding index (CFI) scores through an interaction with child age, but the greatest magnitude was seen on DD. Over time, children from wealthier families had a higher dietary diversity score and by 24 mo, these children were scoring ~0.5 point higher than those in poorer households. This is of public health significance given that 0.5 unit is the difference between getting a food one day and not getting it another day. Thus, our wealth score appears to capture the ability to purchase a variety of foods and the child receiving these foods, while maternal weight has relatively little influence.

I undertook an ethnographic study in 2009 in the same community as that used in Chapter 2 to provide a cultural explanation for the homogeneity of feeding practices. Women in this community have clear criteria about child-appropriate foods and how to best achieve variety in the diet, a cultural consensus for child feeding. Children were mostly fed soups and broths, tortilla, milk, eggs, chicken, some vegetables and fruit, and to a lesser extent beans. Mothers fed children according to the child's sleeping and feeding schedule, and from the home observations, mothers allowed the child to decide how much they would eat. If, for example, one was to expect obese women to feed their children more food, greater portions, and less healthy food (i.e., junk foods) these behaviors would fall outside of the knowledge framework and social norms for feeding children. Thus, women provided foods that fit within their knowledge about child feeding and this knowledge framework may not vary by body size. I was not able to measure portion sizes or feeding frequency in

Chapter 2 with the data available, so the instruments capture broad feeding behaviors. Maternal fatness was not an important factor in child feeding practices as measured by the instruments. Nonetheless, this epidemiologic study needs to be replicated in a contemporary sample of women as women are heavier now than 8 y ago (1). The sample should have a greater proportion of obese women from different social contexts and different feeding practices. Energy density should be considered a main outcome if the data is available. The National Health and Nutrition Surveys in Mexico would be a good dataset to use for further examination of this issue.

In Chapters 3 and 4, I examined the mother-child link from the mother's perspective to understand how feeding unfolds both conceptually (i.e., knowledge) and in everyday practice. I conducted an ethnographic study and used interviews and observations in women in Xoxocotla with children age 6-18 mo.

In Chapter 3, I presented the knowledge structure that influenced child feeding practices in this community. Maternal knowledge consisted of 8 key concepts: (1) *probaditas* (the idea of introducing small tastes of foods), (2) preparing separate foods for infants, (3) readiness to eat solid foods, (4) appropriate consistency, (5) the value of variety, (6) child likes and dislikes, (7) money and food costs, and (8) healthiness of foods (positive and negative foods). The chapter provided a rich explanation of how child feeding unfolds between 6-18 mo. The data revealed that there was a strong cultural prescription for feeding children and variations on the main cultural pattern resulted from broader household factors. Also my field experience revealed that women accessed food from the local market and stores. The food environment (i.e., types of foods and beverages, and manufactured foods) in this community was homogenous.

The data in Chapter 3 have important research and policy implications. Researchers who acknowledge maternal knowledge as a predictor of child feeding

practices can use this information to broaden the scope of inquiry. For example, *probaditas* or food consistency can be used in hypothesis testing, asked in questionnaires to ascertain food exposure or more accurately assess timing of introduction of solid foods. Acknowledging a maternal knowledge framework also provides researchers with useful insights for measuring various aspects of the complementary diet. For instance, it is known that a single 24-h dietary recall are not very useful for estimating true intake and the data presented here suggest that they may also not be useful for estimating dietary diversity given that women conceptualize variety differently than scientists. Food frequency questionnaires or other questionnaires specifically suited to ascertain certain dimensions of the knowledge framework may provide a better indicator of how children are being fed in these types of communities. At a broader policy and programmatic level, an appreciation of the complexity of maternal knowledge may lead practitioners to engage differently with mothers. More importantly, elucidation of a knowledge framework means that there is a knowledge base from which to work. The existence of the knowledge framework also implies that one must consider how intervening to change one behavior may alter other concepts in the framework (i.e., unintended consequences).

In Chapter 4, I took a closer look at the maternal-child interactions around feeding, such as mother and child sharing foods and meals. The methodological approach was to examine the differences and similarities between the maternal and child diet and examine what mothers were preparing for family meals. This was an important objective because it could help explain the composition of the complementary diet and elucidate the social spaces where children could learn eating behaviors. The analysis of the diets revealed that the frequency of shared meals and shared foods was a function of food preferences of the family and the mother, maternal daily activities, and the child's sleeping patterns. The mother ate the foods

she prepared for the adults and foods she prepared for the child, and when mother and child shared foods or meals, they tended to be the child-appropriate foods not adult-appropriate foods. The amount of overlap or degree of shared dimensions between the maternal diet and the child diet also depended on the child's age. Money and preferences influenced the types of foods that were available in the home for complementary feeding.

This analysis situated complementary foods in the broader household food environment. The results suggest that interventions aimed at improving household dietary diversity along with behavior-change strategies for consumption of nutrient dense foods (i.e., vegetables) could improve the foods available for the child. Interventions such as fruit and vegetable subsidies (i.e., vouchers) or community gardens could improve access to fruits and vegetables.

The data presented in Chapter 4 also show the dynamic nature of household food management and preparation. In this chapter, evidence for the social construction of the maternal diet *vis-à-vis* her social roles and relationships was also provided. These findings are important when using dietary recalls as a proxy for household food environment or to estimate intake. The maternal dietary recalls can be considered a good proxy for the household food environment. But using dietary recalls as exposure variables in food preferences and food exposure studies may not adequately capture the mother's behavior. Moreover, in estimating intake, maternal intake might be low on those days when she has eaten more child-appropriate foods. A study of maternal food choice is warranted.

Taken together, the qualitative chapters reveal several important insights for feeding children: (a) there is a discrepancy between IYCF recommendations and practices; (b) the complex maternal knowledge framework and the cultural consensus are an explanation for current practices, and they also provide a good maternal

knowledge base from which to develop interventions to improve practices; (c) the shared food spaces between mother and child are opportunities where mothers can model good eating behaviors and expose children to healthy, new foods, but this requires further qualitative research in these contexts; and (d) the importance of household dynamics in food management and preparation should become part of the inquiry on IYCF. Also, there is a need for more ethnographic studies in Latin America because the way feeding practices are shaped and redefined by social spaces is poorly understood. Given that diets are constructed by social relationships, we need ethnographies in different contexts under different scenarios such as working mothers in highly urbanized settings (e.g., Mexico City), and single mothers living with extended families.

5.2 Social construction of the Mexican diet

The impetus for improving child feeding practices is to reduce malnutrition in infants and young children and prevent obesity via helping to establish good eating habits early on. In the last 15 years, overweight, stunting, and micronutrient deficiencies have been occurring within the same population of children. In poorest homes in Mexico, almost 20% of the preschool children ages 24-72 mo are overweight/obese or stunted, and 5% are stunted and overweight/obese (2). Maternal obesity also coexists with childhood stunting (3) and anemia is reported in 23% of the children under the age of 5 y (4). To observe obesity, stunting, and anemia in the same populations and in the same household is not unexpected given that all are clinical manifestations of an inadequate diet. The diets of mothers and children in this dissertation certainly show signs of inadequacy. For mothers, intake of fruits, vegetables, and milk was low. For children, the diets lacked variety (fruits, vegetables, flesh foods offered infrequently), which are essential for growth and development in this period. Although there were individual level factors that affected consumption,

the centrality of cost in the ethnography points to macro-sociological factors in shaping dietary practices. A larger question is: why are the diets of Mexican women and children inadequate and how did this happen?

To understand these broader changes and why they are happening, anthropologist Sydney Mintz has put forward the idea that people learn both to consume different foods and to consume foods differently (5). For Mintz, a critical appraisal of how food becomes available requires a historical interrogation of the food system embedded within a larger world-historical process. This type of analysis examines the broader issue of power relations or what he calls "outside meaning" (6). The actors who make decisions on food availability, that is those who hold power to construct the food system, include politicians, financiers, merchants, growers, landowners, and businessmen. Power relations and dietary changes in Mexico can be traced back to colonialism. Colonialism profoundly altered the diet of the Aztec people. The foods added to the traditional Aztec diet[30] were wheat (bread and pastries), pastas, beef, dairy, chicken, and pork (7). The deep social divisions between the white and the indigenous population were embodied in the consumption of bread and tortilla. Bread eating was a food habit of the landed class while tortilla and beans were synonymous with being *mestizo* (indigenous and white ancestry) (8).

In 1917, revolutionaries in Mexico attempted to equilibrate power imbalances especially in regard to food access and agricultural production through a land distribution program or *ejido*. The *ejidos* were communal lands owned by a collective of peasants that could not be sold. A main purpose of the *ejido* system was to use the land for small-scale farming (2-3 hectares). I consider the *ejido* system briefly because

[30] Aztec diet mostly consisted of maize. Beans, squash, tomatoes, chilies, potatoes, sweet potatoes, peanuts, limes, and greens and chocolate and fruits were eaten to add variety to the maize-based diet (7). Meats of birds, frogs, insects, and fish were also consumed on occasion (7).

the data for this dissertation came from women living in a once *ejido* community in the lowlands of Morelos, Mexico. In his book, *A Legacy of Promises*, de la Pena (9) narrates the various social relations of the *ejido* farming system in the state of Morelos. According to de la Pena, in 1938, the federal government encouraged the *ejidatarios* (men) in Morelos, through credit and provision of inputs, to grow sugar cane or rice as cash crops to be sold for export. Commercial agriculture began to develop more fully after 1950, with tomato, onion, alfalfa, and sorghum grown for the national market (9). Most *ejidatarios*, in addition to working their small plots, also worked as agricultural laborers on larger private farms. Even though *ejidatarios* were largely self-reliant and produced the staple food items (maize, beans, chicken, fruit, vegetables, and chilies), they still used money to purchase meat, milk, oil, sugar, pasta, and carbonated beverages (according to de la Peña, the consumption of carbonated beverages was related to poor access to potable drinking water). After 1950, with the push for an intensive commercial agriculture system, the *ejidatario* became highly dependent on money to grow and buy food (9). From 1960-1975, the Mexican government responded to the increased monetization of food by subsidizing the cost, through various social programs, of tortillas (Fidelist), beans and corn (CONASUPO), and milk (Liconsa) (10). CONASUPO, however, was more than a food subsidy program. Through its provision of fertilizers and seeds CONASUPO supported the livelihoods of *ejidatarios* (11).

When Mexico defaulted on its debt in 1982, the World Bank (WB) and the International Monetary Fund (IMF), through their structural adjustment programs (SAP) and loan conditionality, facilitated the dismantling of the *ejido* system (i.e., privatization of the *ejido* lands). This promoted land consolidation and large-scale industrial farming quickly ensued (12). To earn a living from the land now required large plots of lands, machinery, and industrial inputs (seeds, fertilizers). These

requirements were practically inaccessible to most small-scale farmers. For most *ejidatarios* the viable options were to suspend farming the land (and engage in full-time wage labor) or sell their plots if they could make a good profit. Some *ejidatario* families stayed where they were and some were able to continue farming, but others migrated to other parts of the country or to the United States (13).

In Mexico, the political support for export agriculture in the 1950s, manifested through credits, equipment, land use, and irrigation policies, and then further institutionalized through North American Free Trade Agreement (NAFTA) in the mid-1990s, drastically changed agriculture (14). Mexico went from predominantly subsistence farming to export-oriented farming. Land once devoted to produce corn and bean for domestic consumption was replaced with coffee, cotton, tomato, vegetable, and strawberry production for export to the U.S. (15). Through NAFTA Mexico began to import its maize from the U.S and other manufactured goods. Pelto and Pelto (16) have used the term "delocalization" to describe when foods are no longer produced where they are consumed. The delocalization of the diet intertwines food systems such that land used to grow export crops cannot be used to produce subsistence crops.

The transition to industrial farming in Mexico and elsewhere was a political project. Global financiers in the WB and IMF initiated the project through SAP and completed it through the World Trade Organization and the Agreement on Agriculture (14). Transnational corporations worked closely with these financial institutions in creating this political project (14), which guaranteed the flow of food commodities, including maize, across nations for the accumulation of capital in what McMichael has termed "food regimes" (17). Mexico was one of the first of the Third World countries to experience globalization of food commodities, which has deepened the privatization of national food security via corn imports and the political construction of an agro-

exporting food system instead of a well-organized food system based on small-scale farming for provisioning food for national consumption (13). With the dismantling of the *ejido* system, CONASUPO subsidy program was terminated (11). Food subsidies still in place are Liconsa (milk) and Fidelist (tortilla), and in 1997, a food stipend was instituted through a conditional cash transfer program (program *Oportunidades,* formerly Progresa) (10). In contrast to the food subsidies that support food security food for all Mexicans, *Oportunidades* targets the poorest of the Mexican households (poorest 20% of the households), providing a monthly money allowance for food.

Political decisions over the last 60 y have culminated in dietary changes for the lowest income population in Mexico. According to Mintz, those with the power to condition the "outside meaning" also set the boundaries for work, play, meal times, buying power, and child care. Changes in livelihoods (i.e., peasantry to wage labor) produce a new consumer that requires a new diet. The shift from subsistence agriculture to mechanized, large-scale farming displaced millions of Mexicans from the land (de-peasantization). No longer able to produce what they consume, the landless peasants now used money to buy food. What they consumed is a function of their ability to sell their labor power to earn money. Today, about 50% of the Mexican population lives in poverty (18). Household purchasing data from 1984-1998, shows that Mexicans purchased fewer fruits and vegetables (-30%), meat (-19%), and milk (-27%), while increasing their consumption of carbonated beverages (+30%) and refined carbohydrates (+6%) (19). During this same time there was a net increase in the price of vegetables and milk (20). In 1997, to help the poorest households purchase higher quality foods (21), a food stipend was provided as part of the conditional cash transfer program. While the stipend makes food and nutritious food more accessible, it nonetheless further monetizes food security and the food system by making the poorest households more dependent on money for food purchases. Also, the

availability of extra money for food may incentivize the food manufacturing companies to produce products for mass consumption that "fit" with changes in work schedules (i.e., instant Chinese soups) and promoting a more aggressive marketing of food products. Social policy aimed at promoting small-scale production of food (such as the one CONASUPO promoted) or communal food production (i.e., community gardens) are more favorable social mechanism through which food security could be improved for the poorest households.

Mintz notes that learning to consume foods differently reflects how individuals, families, and communities cope with change in their social environment. Cognitively and symbolically, people create new frames of reference and modify the meaning around food (5). This process is what Mintz calls "inside meaning," which arises within the home life as a result of the outside meaning. This dissertation has focused on the inside meaning for child feeding with little consideration of the power relations that give rise to how complementary feeding practices are structured. The data in this dissertation suggested that outside meaning can potentially shape inside meaning around child feeding. For example, that fruit-flavored drinks are provided to young children resides in the positive attributes of fruit, so when unable to purchase fruits to make natural fruit juice mothers choose an "appropriate" alternative and thus new meaning is created around these manufactured, sweetened beverages. The marketing of manufactured products also helps constructs new frames of references. For example, in this study, the use of Danonino or Yakult may in part be attributable to the marketing of these products as nutritious.

In studying food choices that lead to malnutrition in low-income and middle-income countries, nutritionists have used various strategies to get at the inside meaning. Cognitive psychology, ethnography, symbolic interactionism, and other social theories are used to elucidate why people choose the foods they do. As a field,

however, researchers have not given serious methodological consideration to the study of the outside meaning and dietary change. Many nutritionists acknowledge that food preferences, personal food choices, and diets are shaped by broader social factors (22). Researchers include these as variables in the analyses, reducing them to confounding factors. Others have moved a step beyond confounding and have identified larger social processes—urbanization, technology, and demographic shifts—and dietary change but the outside meaning (power relations) is never critically examined. Mintz (5) suggests to think of those who supply food as holding a vital source of power because they have an ability to bestow meaning. Meaning coalesces around relationships, and it also coalesces around the use of food or a particular food product and its role in daily activities (5). To uncover the outside meaning would lie at the center of nutrition for social change.

What are some of the ways the field of nutrition can examine outside meaning or power relations? It might be useful to draw on interdisciplinary insights from development sociology. McMichael and Friedmann (17), two development sociologists, propose that agriculture production and food consumption be viewed syntactically as the impetus for world capital accumulation in a "food regime" analysis. The nutrition researcher can employ a food regime analysis on current dietary crisis in Mexico and would (a) historically examine Mexico's relation within the modern global food system, and (b) analyze the policies that have governed food production (imports and exports) and public health, including how they bestow power on those large-scale food producer and processers, while disempowering the people nutritionists are usually trying to help. In this type of approach, the diet problem is a manifestation of a political problem.

Others have proposed a complete paradigm shift in food and nutrition policy and research. Lang (23) proposes an ecologically integrated paradigm based on the

principles of agroecology where ecology, food production, consumption, and human health are interconnected, and research and policy are a manifestation of their interconnectedness. These types of principles promote a local food system that produces affordable foods while making small-scale farming a respectable livelihood and enhancing connections to local communities and local ecologies. These local food systems help ensure a basic supply of staple crops and cohesive communities, which are important for healthy child development.

Nutritionist must address the inside and outside meaning simultaneously to achieve sustainable changes in child feeding practices. In this dissertation, money was one way in which the larger issues of the food system affected a component of the knowledge structure. Yet even if participants in this present study had all the money necessary to purchase food, this would not change many of the concepts underlying child feeding practices because for some concepts, such as *probaditas*, healthiness or consistency, money was irrelevant. Thus, behavior-change interventions are necessary to improve practices and modify the meaning of complementary feeding. The *Oportunidades* program works to improve child feeding through nutrition talks (24) and more recently using behavior-change messages to improve child feeding practices in general (Anabelle Bonvecchio, Mexican National Institute of Public Health senior researcher, January 2010, personal communication).

But eating is more than having nutrition knowledge or beliefs. Eating is socially constructed and depends, among other things, on work schedules and household dynamics. Food stipends and behavior-change interventions will ameliorate food insecurity and improve practices, respectively, but neither of these adequately address the power relations that structure eating habits. Changes to work schedules, living arrangements, and migration to the cities profoundly impact eating habits. In Mexico, these social changes resulted from changes in livelihoods (from a peasant,

agrarian society to industrialized societies reliant on wage labor). Therefore, social policy that supports livelihoods to promote household food security (e.g., small-scale farming), decommodifies food relations (food is simply not just an item of international trade) through rebuilding community food security (e.g., community gardens for the working poor) or improves work schedules and wage earnings so that there is sufficient time for home-food preparation are ways to shift power and address outside meaning. The conditional cash transfer program, as currently structured in Mexico, does not address the issue of power because power is not transferred from the politicians and financiers to the households or communities, although the program through its food stipend and conditionality ameliorates the negative impact of unequal power relations.

In regard to child feeding, the broader power relations are shaping new frames of references and changing how mothers use food products for their young children. Two examples provided here were the use of fruit-flavored manufactured beverages and fortified products to improve child health. Power relations that structure changes to the work schedules of the father—fathers at home for more meals—and promote maternal employment have the potential to change the young child's food space. For example, because the father is home for more meals and the meals are prepared with *chile*, the child is more likely to receive soups or broths as an alternative, which are not the foods needed to ensure optimal growth and development. When the mother is employed outside the home, someone else is responsible for feeding the child and mothers will make different decisions about child feeding (e.g., breastfeeding vs. formula feeding). These broader changes in livelihoods provide new challenges and opportunities for improving child feeding practices, which should be addressed with both nutrition education and behavior-change strategies and advocacy for social policy that addresses the larger power relations in the food system.

5.3 Summary

This dissertation revealed novel information on IYCF practices and maternal characteristics. Maternal knowledge of feeding children is complex and it underlies the practices we observed in this community. There was substantial homogeneity in feeding practices and food environment, and thus maternal weight was not an important factor in breastfeeding duration, dietary diversity or child feeding practices as captured by our index. As women continue to get fatter, as infant formula becomes more accessible, and as the food environment changes, the results in chapter 2 may be less applicable.

Regardless of maternal body weight, IYCF practices need to be improved, and this may be best achieved by using the maternal knowledge framework. This dissertation provided evidence that mothers choose complementary foods from those available in the home and the price of foods are an important factor in their food purchasing decisions. In the current Mexican food system, access to nutrient-dense foods is increasingly limited by low earned income and the rising price of food (20), as Mexicans are no longer growing the foods they consume (i.e., local subsistence). Moreover, international political agreements now make Mexico even more dependent on global food prices. Researchers must consider the broader power relations that are inherent in food and advocate for social policy that distributes power equitably in the food system. For example, advocacy for small-scale farming to make rural livelihoods viable and dignified, financial and social support for community gardens in larger cities for the working poor, and subsidy of vegetables and fruits to make them affordable. To incorporate this into the evidence base would provide proof to policy makers that large-scale improvements in nutrition and human capital are achievable through large-scale restructuring of social food relations.

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